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AIR FORCE

and SPACE DIGEST

The Magazine of Aerospace Power / *Published by the Air Force Association*

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CAN WE LIVE WITH A NUCLEAR TEST BAN?

(See page 37)

"Blanca," underground nuclear experiment at Nevada test site, October 30, 1958. ▶

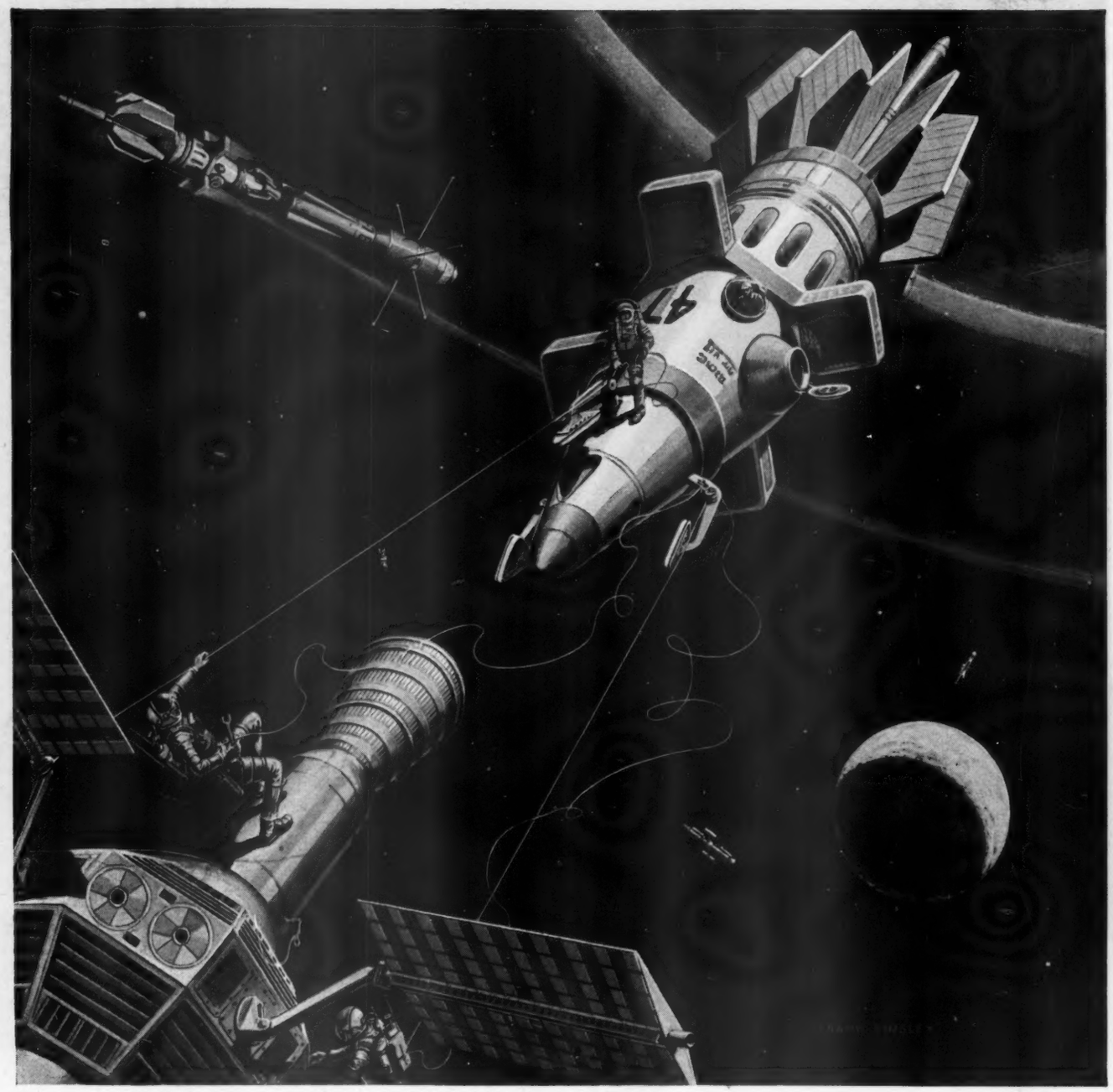
POSSIBILITY • A ban on all nuclear testing

FACT • Underground nuclear tests can be made in secret

CERTAINTY • The US would not violate a test ban

CERTAINTY • The Soviets could violate without detection

CONCLUSION • Such a test ban would be unrealistic. could be calamitous



STEPS IN THE RACE TO OUTER SPACE

Breaking a Space Traffic Jam

By 1970 our solar system will be filled with expended satellites—whirling aimlessly in space with dead batteries and electronic equipment, their missions long since completed.

As space traffic increases, these derelicts will have to be captured and broken out of orbit to keep flight paths clear. For this task, special towboats will be designed and crews trained.

Here, step by step, is an account of such satellite capture and destruction:

1. The towboat, driven by electro-particle propulsion, rockets into space at speeds reaching 25,000 m.p.h. Its reversible engines enable it to slow as it approaches the radar-located satellite, and match the derelict's speed as it moves into orbit behind it.

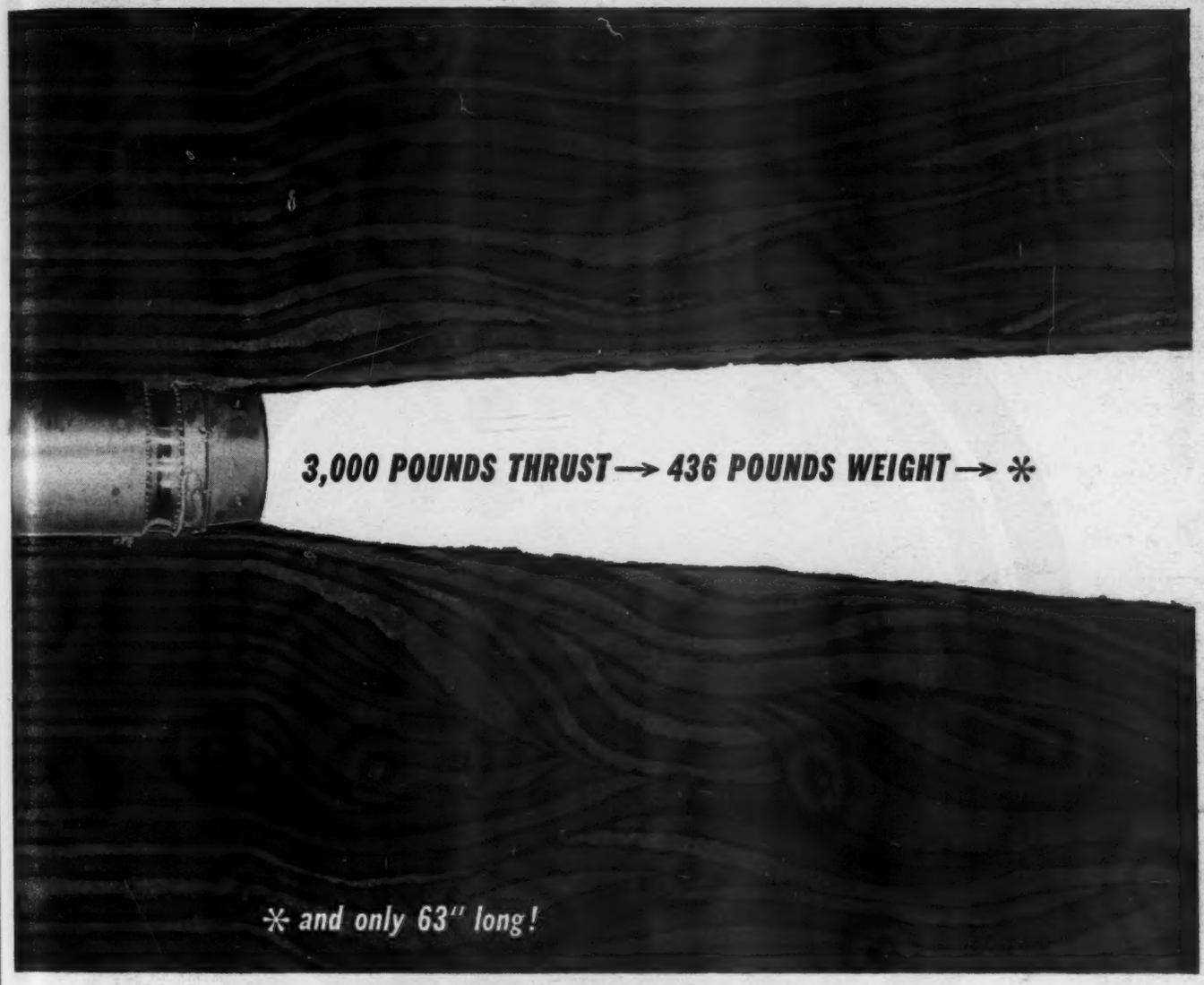
2. Crewmen attach lines to the satellite (as in illustration). Then they haul the towboat forward and its nose cone is clamped to the satellite's rocket nozzle.

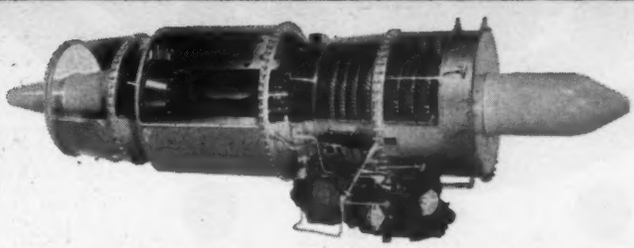
3. The towboat's engines are then switched to full reverse and the linked machines gradually lose momentum, nosing into a spiral path toward the Earth below.

4. When a safe point is reached, the towboat automatically releases the satellite and it is consumed by friction as it plunges into the heavier atmosphere. The towboat, regaining its speed, moves on to its next assignment—breaking a traffic jam in some other congested point in space.

ARMA, now providing the inertial guidance system for the ATLAS ICBM and engaged in advanced research and development, is in the vanguard of the race to outer space. For this effort, ***ARMA*** needs scientists and engineers experienced in astronautics. ***ARMA***, Garden City, New York. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH ARMA CORPORATION

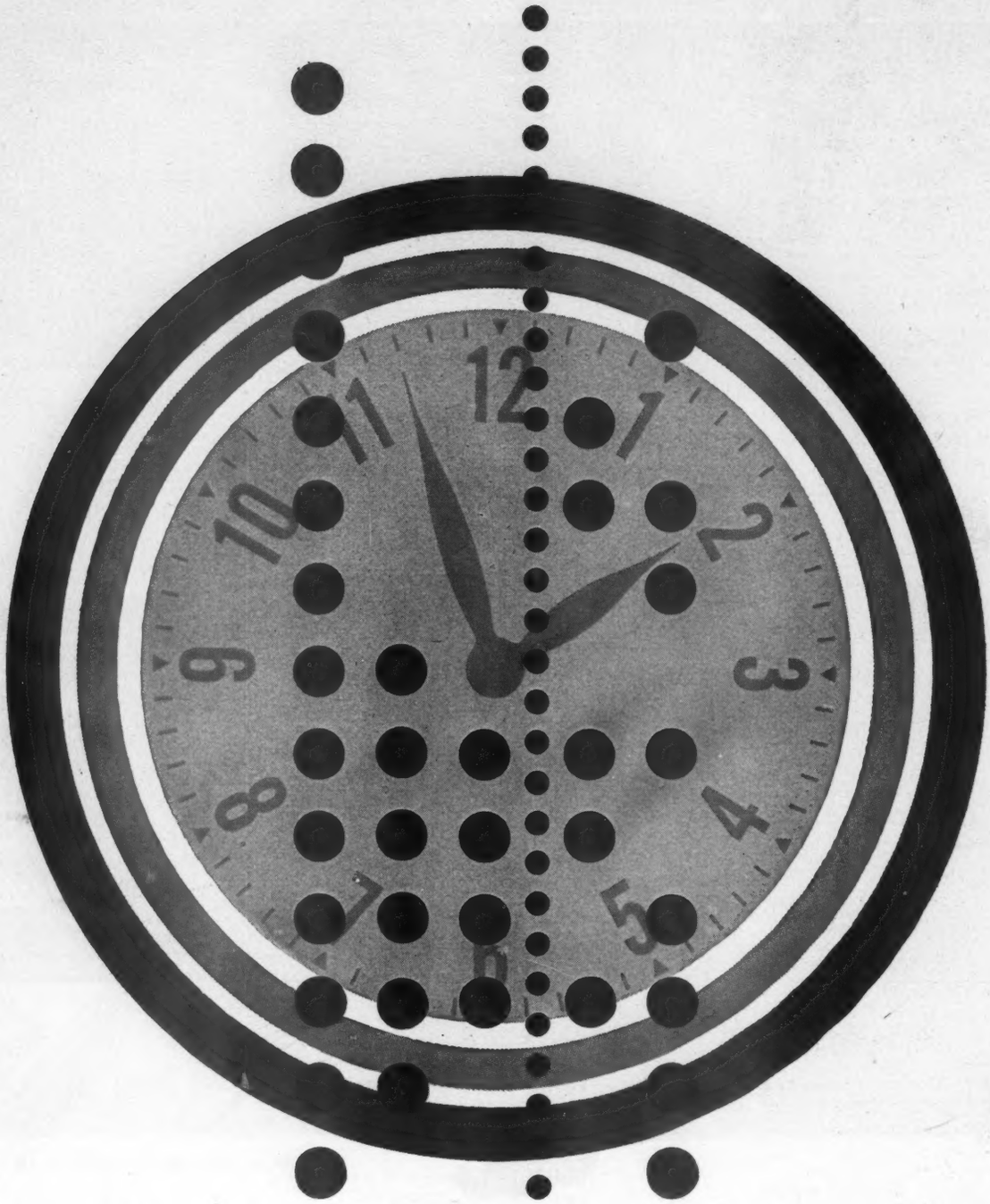




New Pratt & Whitney Aircraft JT12 jet engine is built around proven design concepts for high thrust to weight ratio, ruggedness, reliability and low maintenance.

The JT12 delivers heavyweight thrust in comparison to the light weight of the engine itself. At maximum cruising speed the thrust specific fuel consumption is only .890. A new jet engine designed on a proven principle, the JT12 is an axial-flow, medium-pressure-ratio turbojet. Behind the JT12 stands all the research, manufacturing and testing facilities that produced the renowned Pratt & Whitney Aircraft J-57 and J-75 designs—the new standards of aircraft engine reliability in commercial jet transportation. Because of the sound basic design of the JT12 and its relatively simple construction, it's an outstandingly reliable and easily maintained engine. The JT12 now powers such aircraft as the Lockheed JetStar transport, the North American Sabreliner and the Canadair CL-41 military trainers, and two U. S. Army drones. Today, the JT12 is establishing new flight performance records of its own.

PRATT & WHITNEY AIRCRAFT
East Hartford, Connecticut
A DIVISION OF UNITED AIRCRAFT CORPORATION



TAPE AND MICROSECONDS

are essential to missile development. Instruments must record every function against time... in fractions often finer than one ten-thousandth of a second. Reams of electronic and optical data must be collected, reduced and evaluated before any missile can become operational. Vitro designed, built and helped instrument the Air Force missile test center at Eglin Air Force Base, Florida. Today it operates the center's test ranges and tracking stations throughout the Southeast. At Eglin, Vitro and the Air Force, working as a team since 1952, are responsible for checkout of missiles, rockets, weapon systems, countermeasures, space probe vehicles and bombing techniques. Beyond this Florida site, other Vitro capabilities: underwater (torpedo) and electronic environmental ranges.

SCIENTISTS AND ENGINEERS: JOIN THIS TEAM.

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AIR FORCE

THE MAGAZINE OF AEROSPACE POWER

Volume 43, Number 5 • May 1960

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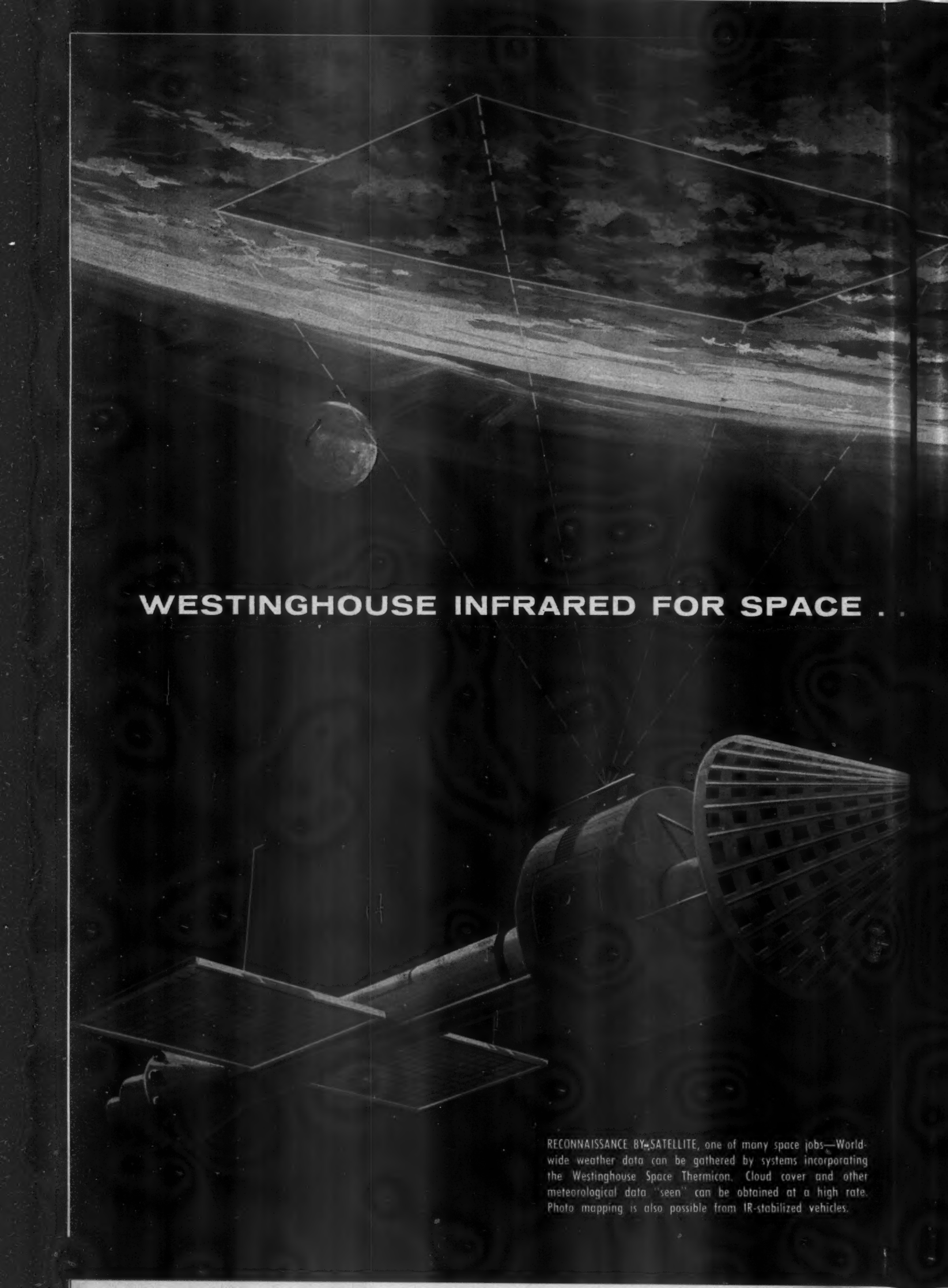
Jones **McQuinn**

TWO NEW ADVERTISING SALES REPRESENTATIVES ARE NAMED

Two new advertising sales representatives have joined the staff of AIR FORCE/SPACE DIGEST. William H. McQuinn, thirteen-year USAF veteran as pilot and information officer, will work with West Coast manager Harold L. Keeler in Los Angeles. Mr. McQuinn comes to the magazine from Douglas Aircraft. Pilot-writer-ad man Paul J. Jones now heads AFA's Chicago office. Mr. Jones, an Army Air Forces veteran, was formerly vice president of the *Aviation Business Directory* publishing firm, and before that he was assistant advertising manager of *Flying* Magazine.



RECONNAISSANCE BY SATELLITE, one of many space jobs—World-wide weather data can be gathered by systems incorporating the Westinghouse Space Thermicon. Cloud cover and other meteorological data "seen" can be obtained at a high rate. Photo mapping is also possible from IR-stabilized vehicles.

1. SATELLITE STABILIZATION—Satellites must keep fixed positions in orbit if they are to perform the vital jobs foreseen for them. A key element designed for such systems is the Space Thermicon, an IR development at Westinghouse. This lightweight, static, electronically scanned "heat-seeing" device operates day or night, guiding the satellite by detecting and responding to Earth's infrared radiation.

2. DETECTING OBJECTS IN SPACE — Fire control systems in stabilized satellites can be designed around advanced Westinghouse infrared equipment. Here static, electronically scanned sensors with a wide field of view can detect and track objects, providing data at a high rate with high accuracy and top reliability.

3. IR COMMUNICATIONS — Westinghouse developments will permit use of active infrared radiations to carry voices or other signals on a narrow microwave beam. Such a system would be almost impossible to detect or jam. It uses low power and requires little weight, and yet is useful for most communication requirements. Its "security" makes it particularly valuable in military applications.

HERE ARE A FEW OF ITS IMPORTANT APPLICATIONS

4. AIRBORNE DEFENSE — Westinghouse-developed infrared devices, techniques, and systems, to detect and track enemy missiles or aircraft, offer vital advantages in both bomber defense and interceptor fire control systems. Such systems operate in daylight as well as darkness. Effective differentiation between targets and background is obtained.

5. TANK FIRE CONTROL — Infrared systems developed by Westinghouse offer special advantages such as 24-hour fire control capability. They are rugged, compact and cannot be detected by an enemy. Electronically scanned sensors eliminate problems of complex optical or mechanical linkage.

6. UNDERSEA DEFENSE — A broad program incorporating Westinghouse developments in scanning systems, sensors, and special circuitry make possible detection of submarines in a tactical environment.

Engineers at the Air Arm Division of Westinghouse Electric Corporation are developing a variety of advanced infrared systems for the Army, Navy and Air Force . . . another demonstration of *Westinghouse Capabilities for Defense.*

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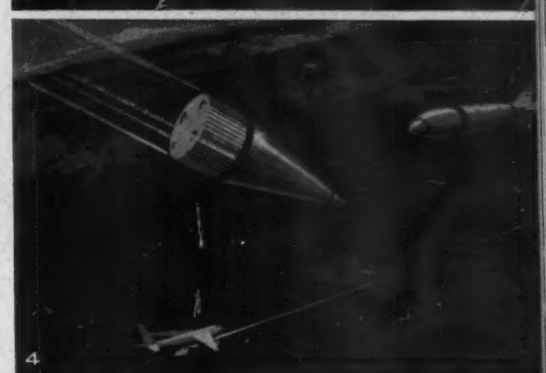
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WESTINGHOUSE

DEFENSE PRODUCTS GROUP

1000 Connecticut Ave., N.W., Washington 6, D. C.

J-02313

The Nation's Great Decision

Decadence or Dedication?

On March 26, the Board of Directors of the Air Force Association, meeting in Washington, D. C., unanimously adopted the following statement concerning the peril which the United States faces from the challenging power of the Soviet Union.

OUR forefathers created this nation through imagination and hard work. They passed on to us a land of power and plenty—a nation dedicated to freedom.

Today, we as a nation are in the process of becoming decadent. Signs of this are (1) our unwillingness, as a nation, to work, and (2) our inability, as a nation, to think.

We want security without effort. In the world of thought, we more and more rely on columnists and commentators to render our judgments for us.

Over the years the world has seen many nations and many cultures become decadent and die. Their decadence has often been attributable to, or accompanied by, a general loosening of moral values. This symptom is present in our nation today. But beyond this, nations fall because they become soft; they tend to rest when they have attained the top of the heap; they are satisfied with the *status quo*. Here, again, we can see ourselves today.

But, thank God, our decadence may yet be in an incipient stage. We still possess—latent to be sure—national and individual attributes of courage, intelligence, and integrity which, if teamed with work and sacrifice, can pull us from lethargic decay. But, historically we have risen to our full national stature only in times of great national emergency.

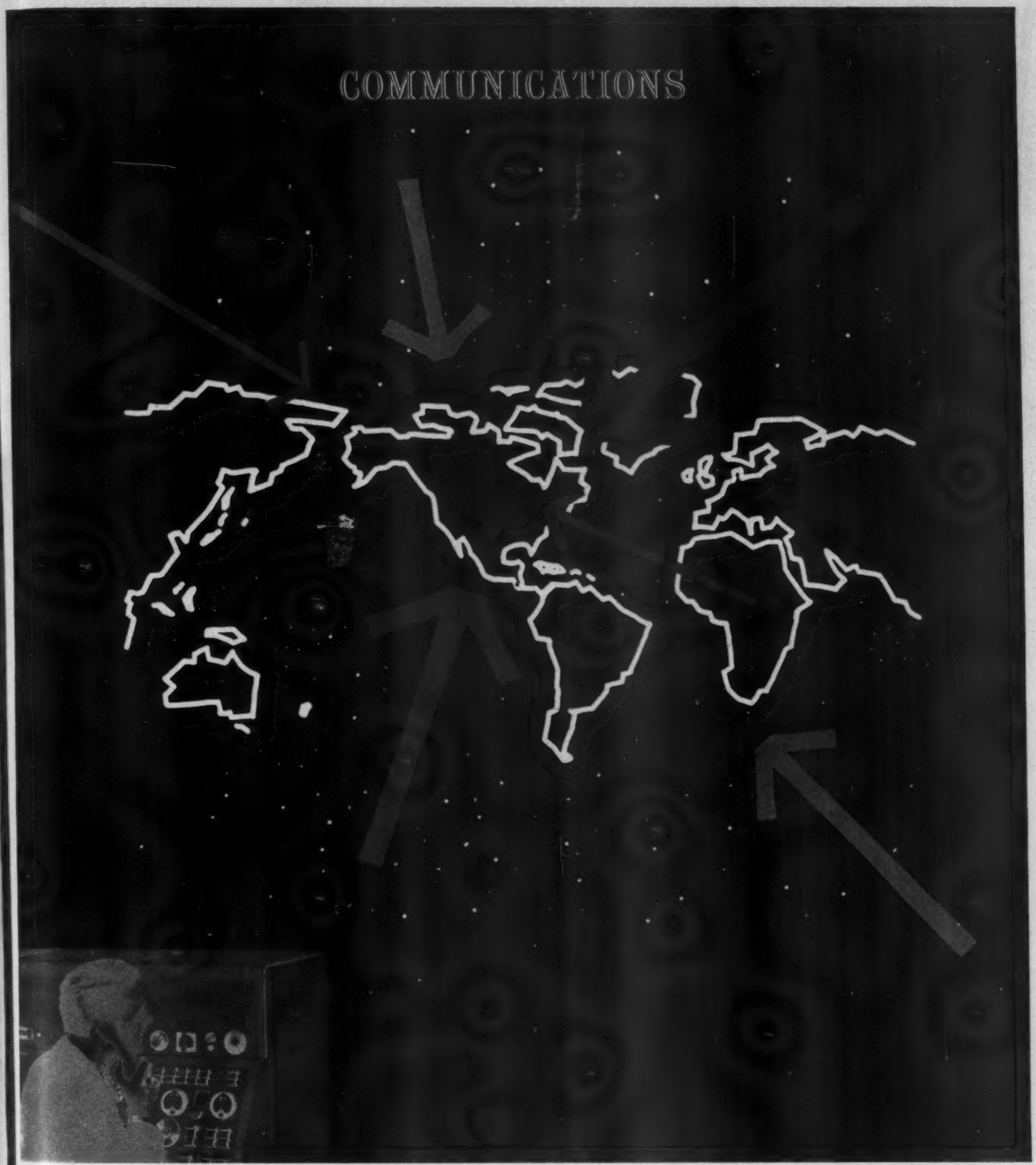
Such a national emergency exists today. We are at war. In the military sense we are sparring. Ideologically and technologically, we are in all-out conflict. Economically, the war is about to begin. We face a determined adversary who is as energetic and dynamic as we were 150 years ago. It has an objective, a plan, leadership, and determination directed toward one goal—Communist domination of the entire world.

- We must exert every effort to conserve our national resources. We must achieve full utilization of our military power through a unified military establishment, as has been spelled out in Air Force Association Statements of Policy in 1956 and 1959.
- We must produce more, work harder, and when necessary, sacrifice to build our military strength—particularly our aerospace power. The Air Force today is forced through budgetary factors into making unfortunate compromises, based not on what is needed but on what can be had.

The B-70 gutting, the F-108 cancellation, the ill-equipped condition of MATS—all are symbols of deteriorating power. Our unwillingness to support these and other vital programs is but a symptom of our general softness.

- We must build our technology to a position of leadership in every important field.
- We must build up our economy to ensure our ability to compete over the long haul.
- We must, looking within ourselves and our institutions, tighten our morality so as to warrant the position of free-world leadership in which we, as a nation, find ourselves.

There is no alternative but decay and ruin.



your call, sir... That call may come via satellite relay or over a long-distance scatter circuit. It may originate from robot-like circuitry—or come from deep outer space. There's a revolution going on in communications, and we at Bendix Radio have a big hand in it. We're providing communications for Task STEER and Project MERCURY; we are doing something different in scatter. We're under contract to develop unusually compact personal radios, basic transceivers for space projects, and low-noise receiver designs; we are leaders in subminiaturization and modular packaging. For the most advanced operational features available in communications, you'll do best at Bendix Radio.

Bendix Radio Division

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Bendix
AVIATION CORPORATION

"TURN RIGHT HEADING 270°...

ONE MILE FROM TOUCHDOWN...

ON COURSE...

ON GLIDE PATH..."

NEW GILFILLAN "TALKING RADAR" TAKES THE GUESS OUT OF JET LANDING GUIDANCE

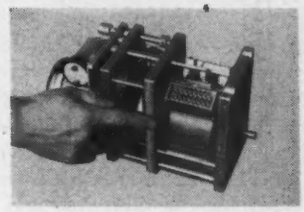
Supersonic jet speeds leave no margin for error inevitable when a radar operator must visually estimate aircraft position, decide guidance required and communicate three-dimensional data to the pilot.

The solution: New Auto Voice GCA–Gilfillan's new "talking radar" that is also a "thinking radar."

Through every moment of landing approach, Gilfillan Auto Voice GCA Radar computes precise aircraft position with infallible electronic accuracy... selects required data from a standardized R/T voice drum... transmits this guidance to the pilot instantly, including instant warning and course correction should the jet begin to deviate from safe approach limits.

The pilot is assured the infallible, accurate, instantly delivered guidance that is vital for jet operation. The radar operator monitors the approach, with undistracted readiness to communicate directly to the pilot in the event of any emergency.

Gilfillan Automatic-Voice GCA Radar eliminates one more problem of the human equation in the jet age.



30-TRACK VOICE DRUM
Includes pre-recorded standardized R/T commands on 27 tracks; 3 spare tracks for recording data needed at an individual location. Also has multilingual capability.

GILFILLAN FORESIGHTED PLANNING SAVES TIME AND TAX DOLLARS

Aircraft, missile, and space vehicle design is advancing so rapidly that ground electronic systems produced to meet current needs are in the process of becoming obsolescent at the time of installation.

The cost of replacement of such systems in terms of tax expenditures is self-evident. Less evident, equally important, is the cost of new development and production, new installation, new operator training and new spare parts.

Only experienced, foresighted research and development and on-time production can stay ahead of jet and space age advances. Gilfillan's on-time record is outstanding. Gilfillan ability to design for planned non-obsolescence is recognized, and proven many times over.

One example is Gilfillan Auto Voice GCA – an *accessory* to flexibly designed Gilfillan GCA Radar systems in operational use throughout the world since 1944. New Auto Voice adds jet age capacity to these *existing and proven* GCA systems–in minimum time, at minimum cost, and with minimum changes in training and spare part supplies.

Gilfillan's experienced, foresighted planning is available for complete research, development and production in the fields of Air Navigation, Electronic Countermeasures, Missiles Systems and Instrumentation, Radar Trainers and Ground Support Systems.

GILFILLAN DESIGNS FOR PLANNED NON-OBSOLESCENCE

Multi-aircraft automatic-voice computer.

Gilfillan

Seven Gilfillan Plants in Southern California
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Los Angeles, California

AMERICAN AIRLINES JETS NONSTOP BETWEEN NEW YORK AND SAN FRANCISCO

From San Francisco, New York is only hours away! You'll arrive nonstop at American's magnificent new Passenger Terminal at Idlewild Airport. This strikingly beautiful terminal is revolutionary in architectural concept and in passenger service.

American Airlines offers two nonstops to New York every day. Also, there are three nonstop jets to Chicago (one flight continues on to New York; another flight continues on to Boston) plus convenient 707 Jet Flagship service nonstop to Dallas.

From New York, fly American Airlines jets west. Choose from either of two convenient nonstop flights aboard the nation's most proven jetliner—the 707. There's also an additional Jet Flagship flight every day to San Francisco via Chicago.

It all adds up to complete and convenient jet service to and from San Francisco. For reservations just see your Travel Agent or call American Airlines—first choice of experienced travelers. Choose de luxe Mercury or economical Royal Coachman service.

AMERICAN AIRLINES *America's Leading Airline*

AIRMAIL

Opinions on March

Gentlemen: In reference to your editorial in the March issue of AIR FORCE, I am writing to register a protest against your comments on President Eisenhower and his "personal assumption of the role of the nation's most highly qualified military expert." This is a slanderous remark, and a pitiful parroting of the pathetic bleatings by some of the presidential hopefuls of one of the major political parties. It is wholly uncalled for, and out of place in AIR FORCE.

Your comments imply, by referring to Mr. Eisenhower's experience as gained during and before World War II, that our President has, since this time, existed in a total vacuum away from and totally unconcerned with the defense status of the United States. Nothing, of course, could be farther from the truth. In reality our President has the opportunity and ability to function above the parochial demands of the various services, and to view the defense of our country from an overall basis, and not from the narrow outlook of any single branch of our Defense Department.

This is the only salvation of our country, certainly, because if we ever knuckle under to the "spenders" in this country and give them unbridled rein with our tax money as it is spent for defense, they will as surely destroy us through economic bankruptcy as certainly as any Russian missile or bomb. And the tragic part is that if we *did* give them *all* they asked they could not then assure us that they could prevent an enemy missile or bomb attack if an aggressive enemy decided to launch it against us.

I am a member of AFA, and was a member of the Air Force, and as a citizen today I am as concerned over the safety of the United States as any citizen. But I am also a citizen fully aware of much duplication in our defense effort, of enormous waste, of interservice bickering. . . . I read about the discovery of an unknown earth satellite by the Navy, who for a considerable length of time kept this discovery a secret from the Air Force for no apparently good reason except that they must have wanted eventual credit for its discovery. Who am I to believe in this controversy over our defense effort? Some Pentagon admiral who sits on critical information of this nature? Or our President who, advised on all sides by the most competent people we can get for this work, is struggling to keep us strong that we may be kept free?

I believe our President is, today, informed on all aspects of our defense effort. I believe he is, perhaps, the most competent man in our country today to assimilate and utilize these facts to provide us with the best possible defense we can have. If the time comes when we have to use this defense, it may or it may not be enough. But if it isn't, it will *not* be because of any lack of qualification in the field of understanding of military preparedness by Mr. Eisenhower.

There is currently appearing in a number of publications an advertisement containing a provocative thought: "When small men cast long shadows it is a sure sign the sun is setting." Perhaps, and most likely, if we some day fail it will be because of some inherent failing in our system that caused small men to cast long shadows that frightened us.

Charles L. Lyle
Birmingham, Mich.

● *It may appear presumptuous to disagree with the President as to the nature, composition, and cost of our national defense effort. But we think it equally presumptuous for him to imply that anyone who does so disagree is necessarily less knowledgeable on defense matters. This would take in a large number of qualified people far beyond any presidential hopefuls.*

It would include, for example, Mr. Robert Lovett, an extremely capable Secretary of Defense and Assistant Secretary of State in the Truman Administration—posts to which he was appointed even though he was and is a lifelong Republican. It would include Mr. Robert C. Sprague, Chairman of the Board of Sprague Electric Company. Mr. Sprague was appointed by the President to serve on the Gaither Committee, which came up with such a gloomy assessment of what we are doing in the defense area that it has never been officially released.

Incidentally, Mr. Sprague wrote us concerning the editorial to which you take exception: "[It] expresses points of view with which I have a great deal of sympathy."

The list would also include Mr. Emmet John Hughes, who at one time was the President's speech writer and who has written of the same editorial: "The principles you set forth seem to me, in themselves, quite beyond debate. And they are most cogently stated."

It would include many others who have no political axe to grind. All would admit that they might be mistaken, but to err on the side of too much military strength can only cost money. To err in the other direction could cost us our country. This position has nothing to do with partisan politics. We have been just as critical of Mr. Truman. Neither does it have anything to do with interservice rivalry. We are very conscious of duplication, waste, and extravagance in our military effort but these problems aren't solved by saying, "There, there! Everything's going to be all right. Daddy's home."—THE EDITORS

Gentlemen: Bravo on your March editorial!

Devon Francis
Popular Science Monthly
New York, N. Y.

Gentlemen: . . . In the March issue Senior Editor Claude Witze argues for the advisability of continuing the B-70 program in at least its original magnitude. In this I concur. But I find it extremely difficult to follow the argument as to the "financial threat" (to the USSR) which the program is assumed to constitute. Mr. Witze asserts that "the shift to Mach 3 in our manned offensive system would force the Kremlin to launch a backbreaking program of new weapons . . . [and that] there is no reason to doubt that they can do it, but the cost is something that would almost certainly stagger Mr. K in his program to provide more consumer goods for his public."

(Continued on following page)

I find this highly questionable reasoning, particularly for an analyst of Mr. Witze's stature. If there is "no reason to doubt" the Soviets can develop the new weapon systems to cope with the B-70, then it follows that the program will not be backbreaking to them. The use of this term is suggestive of the tendency to underestimate our opposition—as was manifestly the case as to their A-bomb, H-bomb, and space vehicles—as though all we need is the dough and the good old American "drive" and those "backward Russians" will be left in the dust. This is patent nonsense at this stage of the game, if not actually dangerous. . . .

The true argument for the B-70 (and other programs) is that of the "technological imperative" which leads (all antagonists) from one development to the next, hoping to achieve a measure of military superiority.

As to the cost of a Soviet anti-B-70 program and its presumed impact upon their consumer goods output: exactly why should we want them to put their resources into military hardware (to be expended on us?) as against absorbing the resources in consumer goods? What is the advantage to us of forcing a curtailment in their consumer goods program? Is it the belief that this might cause "unhappiness" among the Soviet citizenry who would then put pressure on Mr. K, perhaps force him out of office? Surely we're all aware that the system doesn't operate quite that way in the USSR! . . .

If this is so—and I think it is—what are we to gain from a reduction in the pace of the Soviet consumer goods program (assuming such a reduction would result from a costly anti-B-70 program)? Nothing of favorable consequence to us that I can see. On the contrary, possibly quite the reverse, for if we are to hope for any real changes in Soviet attitudes, policies, and in their system—and a reduction in the threat these constitute—it would seem more likely to come from a general *improvement* in their living standards, rather than from a worsening or stagnation. Moreover, why should we not wish a higher standard of living for the Soviet people? If nothing else, and as we know all too well, the better off a people are, the less sensitive and aggressive, the less purposeful, they are.

No, if Mr. Witze's arguments are intended to bolster the general one for the B-70, they are inadequate—more likely, indeed, to achieve the contrary effect.

Bear in mind that I argue for the B-70 program (and for the F-108 as well). But the argument, I think, is that of the military-technological imperative. Such questionable arguments as those above tend to create unwarranted suspicion of the motive behind the program.

Capt. Charles Konigsberg
Princeton, N. J.

● *We certainly agree with Captain Konigsberg that the primary arguments for the B-70 are military and technological. These arguments were effectively set down in our January issue.*

The budget argument is that we can't afford the B-70 program. On the contrary, we can. Furthermore, if the cold war is partly an economic war the B-70 will constitute an economic blow to Russia, much greater than the shock we will feel in our economic arena.

If economic pressure is part of the cold war, and the Russians clearly think it is, don't we have to use the weapon?—THE EDITORS

Controlled Peace

Gentlemen: I have circulated copies of the article on controlled peace [March issue, page 61] among the seniors in our company for their information and have read it carefully a number of times myself. We feel that Mr. Straubel has succeeded in bringing before the people a concise digest of the objectives of our programs of today.

We have a large list of subscribers to AIR FORCE/SPACE DIGEST in Aeronca. We use it regularly as a guide to thinking and as a guide to management.

Edward M. Fickett, Manager
Public Relations & Advertising
Aeronca Manufacturing Corp.
Middletown, Ohio

UNIT REUNIONS SCHEDULED FOR THIS YEAR

468th Bomb Group—July 29-31
Spring Rock Country Club, Spring Valley, N. Y.
Contact: Denny D. Pidhayny
5318½ Packard St.
Los Angeles 19, Calif.

CBI Veterans Association—Aug. 3-6
Roosevelt Hotel, Cedar Rapids, Iowa
Contact: Ray Alderson
1503 Delhi
Dubuque, Iowa

385th Bombardment Group—Aug. 5-7
New York, N. Y.
Contact: R. G. Weikert
966 N. Meridian St., Rm. 206
Indianapolis 4, Ind.

390th Bomb Group—date and site unknown at present
Contact: Col. Robert W. Waltz
Det. 5, Hq. 26th Air Div.
Stewart AFB, N. Y.

ALPHA CAPABILITIES

Systems competence in design, implementation, structural construction, installation, operation, training, and maintenance of:

1. *Space surveillance systems*

2. *Transportable electronics systems*

3. *Instrumentation, control, and switching systems*

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What's New With ★ RED AIRPOWER

Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.

Will Russia put a man into space ahead of us? It's anybody's guess—but no one should be surprised if the answer is yes. The Soviet Union's two long-range, highly accurate ICBM shots into the central Pacific early this year made this seem even more likely.

The shots once more demonstrated the impressive thrust of Soviet rocketry. They also demonstrated that Russian guidance capabilities may well be equal to ours—and that she has come a long way in meeting reentry problems. Reentry is as essential to bringing a man back from space as it is to getting a ballistic missile to descend intact on target.

The Russians have denied on numerous occasions that they are in a hurry to get a man into space. This despite scattered reports of a Red crash program along these lines. Rumor even has it that launch failures resulted in death for a number of prospective Russian astronauts.

Yet high-level appraisals here and abroad, based on intelligence reports and obvious Soviet prowess, now indicate that there is a good chance Ivan will be in space before one of our Mercury Astronauts.

One unanswered question is this: How far advanced is Soviet human factors work aimed at preparing men to live through far-out trips? Sources say at this juncture that there is every evidence it is going along very well indeed.

• • •

Premier Khrushchev continues to strengthen his personal control over political, economic, and military phases of Soviet life. A Khrushchev man has recently been appointed to head the important State Committee on Science and Technology, which directs development of most military hardware among other things.

The new appointee is K. D. Petukhov, one-time Minister of Heavy Machine Building. This ministry also is closely associated with Soviet defense industry. Petukhov replaces Y. Y. Maksarev in his new post.

Petukhov, like Khrushchev, comes from the Ukraine.

One problem Petukhov faces is the necessity for a speed-up in the development of computers. Faster development of computers, sometimes known as "electronic brains," is called for in Russia's present seven-year plan.

Advanced computers are essential in numerous phases of modern weapon development. They provide data for ICBM and space launches, would also "steer" antimissile missiles designed to intercept incoming ICBMs.

The Byelorussian Academy of Sciences has come up with a new high-speed computer that can work 4,000 simple mathematical problems in a second.

The Moscow Power Engineering Institute has a new Setun computer operating on a ternary rather than a binary code. Therefore, it is faster and uses fewer components.

• • •

Russia's TU-114 transport, world's largest and most bug-bedeviled turboprop passenger plane, has been doing some underwater cruising. The TU-114 is undergoing underwater pressure tests similar to those used a few years ago to pin down structural shortcomings in the British Comet. A huge water tank located not far from Moscow is the scene of this test activity. The TU-114 has left something to be desired in its capacity to retain internal air pressure at high altitudes; the tests are believed aimed in this direction.

At the same time, vibration studies are being made on portions of the plane's fuselage, which has been subject to cracking. Skin cracks resulting from metal fatigue have been a peculiar characteristic of the TU-114s, one of which brought Premier Khrushchev to the US nonstop last year. Lack of good pressurization has characterized all Soviet transports.

At the same time, the TU-114 is going through proving flights on the Moscow-Khabarovsk run, which connects the Soviet capital with the principal administrative city in the Soviet Far East.

• • •

Newest entry into the Soviet aircraft export market is the IL-18, or Moskva, turboprop transport. In many ways the Soviet aircraft resembles the Lockheed Electra —but it differs sharply in export price. The IL-18 will sell for about $1.5 million, about $1 million less than the Electra.

From time to time the Russians have sought to enter the foreign market for aircraft in areas beyond the control of the USSR. The YAK-16 transport was offered to Latin America in the late 1940s without result, and the TU-104 pure-jet transport has also been pushed in vain in Western Europe.

Observers generally concede that the IL-18 has a better chance of gaining overseas sale. Behind the Iron Curtain, East Germany already has committed itself to the aircraft and Czechoslovakia is expected to follow along as well.

• • •

By late next year the Russians will have demobilized 250,000 officers, including a number of generals and admirals, in line with their announced armed force manpower cutback. There has been much fuss over this prospect in the Soviet press, and the usually silent Defense Minister, Marshal Rodon Y. Malinovsky, has been moved to comment publicly that there will be no problem in finding suitable jobs for the rank and file of the armed services who return to civilian life. But there will be some problems in finding suitable jobs for all of the officers, he said.—END

are being built at Satellite Center, U.S.A.

Satellite Center, U. S. A., is located in the San Francisco Bay area at Sunnyvale, California. From Lockheed's vast new Satellite Systems Building come the Agena satellite of the Air Force Discoverer program; the Agena B planned for lunar and deep-space probes; and the satellites for the Air Force's Midas (missile defense alarm system) and Samos (strategic surveillance system).

LOCKHEED MISSILES & SPACE DIVISION SUNNYVALE, CALIFORNIA

AIRPOWER in the news

Claude Witze
SENIOR EDITOR

A Soap Peddler Looks at Defense

WASHINGTON, D.C.

Oliver M. Gale, Jr., who has had twenty years of experience in the soap business, feels strongly that there is too much talk about the need to catch up with the Soviets. He thinks it more pertinent to ask: What can the Russians do to catch up with us? Mr. Gale also finds it hard to believe that a Mach 3 bomber will present an appreciably more difficult target to the ground-to-air missiles of 1965 than a Mach 2 airplane.

Another opinion held by this former Procter & Gamble official is that funds are *not* a major consideration in determining the airborne alert capability of the Strategic Air Command. He lists the Atlas ICBM, of which not more than three are ready for launching from their West Coast home, as part of *today's* nuclear deterrent force. Again, counting airplanes like cans of Crisco on a supermarket shelf, he sees in our arsenal "over 2,000 long-range strategic bombers," each one of them more potent and accurate than missiles. Reliance on these bombers, Mr. Gale opines, "makes a good deal more sense for the United States than does reliance on the intercontinental ballistic missile."

These thoughts from an expert in industrial merchandising—he helped put Ivory in millions of American bathrooms—would not warrant our attention except for the fact that Mr. Gale says they represent "the combined thinking of the Secretary of Defense and his principal military and scientific advisers." There may be some people who will believe this, because Mr. Gale quit his job in the soap business in 1957 and for two and a half years has been a Special Assistant to the Secretary of Defense. He entered the office with the administration of Neil H. McElroy, who was his boss many of those years at Procter & Gamble, and has remained there as an aide to Secretary Thomas Gates. But despite the location of his desk, which is handy, he did not submit his opinions on our defense stature to the Chiefs of Staff or their Chairman for concurrence. They are, and will remain, merely the statements of a former soap salesman who has had a brief connection with the military establishment.

Mr. Gale, furthermore, made these remarks in a letter on Department of Defense stationery. The letter palpably is a political document. It was addressed to Carter Burgess ("Dear Carter"), a former Assistant Secretary of Defense for Manpower, who has returned to the industrial world as an executive of American Machine & Foundry. The identical letter has been circulated among more than 600 "opinion leaders," according to the Pentagon, which has condoned description of the letter as a "White Paper." This is a term commonly used in Great Britain when the political administration hands down a treatise defending its policies from opposition criticism. A true White Paper is a government report. Mr. Gale's letter is a letter. Anyone is entitled to his own opinion about the propriety of putting this letter, a political document, on a Defense Department letterhead.

Oliver M. Gale, Jr., Special Assistant to the Secretary of Defense.

As you might expect, Mr. Gale contends his dissertation is not a political document. In a polite letter to the *Wall Street Journal* he denies a report in that paper attributing its inspiration to political factors. On the other hand, the essay is being used as a political document, and the credence of the most naive would be taxed by the suggestion that Mr. Gale did not intend it that way. If he did not intend the "Dear Carter" letter to go into the maw of the campaign, he should have stopped, for example, the distribution of an additional 1,200 copies by the National Defense Department of the Chamber of Commerce of the United States. The Chamber evidently agrees with Mr. Gale and accepts him as an authority, that the difference between Mach 2 and Mach 3 is about like the difference between Rinso and Tide. USAF's Chief of Staff, on the other hand, takes the parochial view that reaching Mach 3 "would be a breakthrough in the science of aeronautics." As a threat to the Soviet Union, the Chief says, a Mach 3 bomber wins, "hands down."

It is even more interesting that Mr. Gale is known to have harbored the hope that the letter would come to the attention of newspaper editors and other toilers in the field of public communication. His idea here was simple: With this kind of opinion at the elbow an editor might be more querulous when faced by copy from a Washington reporter quoting some Administration critic. After all, as we pointed out here last month, there has been a long list of impressive witnesses, not all as ignorant and blind as the White House pictures most Democrats. There were the Republicans: Tom Lanphier, Robert Lovett, Thomas Watson, Robert C. Sprague, Dr. James P. Baxter, III. Mr. Lovett, who was one of the testiest men on the stand, has had a lot more Pentagon experience than Mr. Gale and once was Defense Secretary.

(Continued on page 19)

Bell-powered Agena satellites in orbit — symbolized.

THE ENGINE WITH THE FUTURE

Reliability . . . Efficiency . . . Flexibility.
In space, these words have a million-dollar meaning.

Vast sums of money and vital scientific data ride on these built-in attributes of Bell Aircraft's rocket engine for Lockheed's Agena satellite, second stage of the Air Force Discoverer series.

The Agena engine, designed with space in mind long before space became a household word, has fulfilled its every mission and has placed more tons of useful payload into orbit than any other power plant. Its operational reliability is backed by six years of development and 5,000 test firings.

This Bell engine now has re-start capability — the first in the nation. This means that its satellite can change orbit **in space** without the penalty of extra engines. Presently in production, this engine also is adaptable to new fuels and new assignments and, consequently, is programmed for important military and peaceful space ventures of the future.

Agena's engine is typical of the exciting projects in Bell's rocket propulsion center. It is part of the dynamic new approach of a company that's forging ahead in rocketry, avionics and space techniques. These skills serve all government agencies. Engineers and scientists anxious for a new kind of personal challenge can find it at Bell.

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MARTIN

So far, Mr. Gale has been disappointed, we suppose, with the influence of his "Dear Carter" letter on the more-or-less adamant American press. Mr. Burgess is known to have distributed the message, and Mr. Gale has had requests for copies. Those who get it will have seventeen typewritten pages arguing that there is no deterrent gap.

Queries Mr. Gale:

"How can serious students of the defense situation set aside many thousands of megatons of nuclear potential and limit their debate to a single weapon system just because the Russians—void of overseas allies, lacking carriers, unable to reach us with intermediate-range ballistic missiles or tactical weapons—have been forced, whether they chose it or not, to concentrate their energies primarily into a single channel in developing their strategic nuclear capability?"

The answer, of course, is that "serious students" don't do any such thing. Serious students, even including some of the Joint Chiefs of Staff, also know the Russians have not been "forced" to concentrate on the ICBM potential. It is their easy way out, one that is not available to us. We need these many thousands of megatons of nuclear potential, with all their diversity and flexibility. We have worldwide obligations. Russia is the arsenal of the Communist world. We are the arsenal of the free world. Our defense problem is far more complicated and expensive than theirs.

The depressing thing about the "Dear Carter" letter is that it pursues the argument that a minimum deterrent is all we need and never mind about winning the war. This is an approach that will cripple our national security, alienate our allies, and promote Red aggression all over the world. Yet here it is, all wrapped up in a package, ready for the show window and the commercial plugs on the radio, the advertising campaign and the chant of the medicine man. It is the soap-selling technique applied to a national deficiency. There is dishonesty in the implication that the Chiefs of Staff agree with these opinions, political audacity of their publication on official stationery, and complete incredibility in the qualifications of the spokesman. It is a pity if there is no suitable opening for this talent in the business of peddling soap, which country boys will remember is made of grease and lye [*sic*].

You Won't Believe It

The House of Representatives has passed a bill commonly described as an effort to keep retiring admirals and generals from becoming salesmen for defense contractors. The measure has gone to the Senate. At this writing, with civil rights still an unresolved question on Capitol Hill and the political cauldrons starting to bubble, it is not expected that a proposed law on retired military officers will rate much of a priority in the Senate.

This is good, for a number of reasons. The best one probably is that the House took action without any consideration for existing legislation. The members appear to have overlooked current legislation that makes regular retired officers subject to criminal penalties if they ever sell anything to their own services. If they engage in any kind of selling to the Defense Department within two years after retirement they lose their retired pay.

It was the search for abuse of this law that led to the so-called Hébert investigation last summer. House Armed Services Chairman Carl Vinson has pointed out the results of the inquiry in plain language:

"The subcommittee, after inviting every member of the House to testify, and after hearing the testimony of members and others, did not disclose a single instance in which an officer, retired from the military service, had exercised influence on someone in government to the extent that the product manufactured by his company was selected. No evidence of improper use of influence was disclosed."

In view of this, Mr. Hébert acts like a doctor who has decided to operate on a healthy pair of tonsils. He explained his viewpoint on a television show a few weeks ago when he told an interviewer, "You have to wonder what's going on, even if nothing is going on." These guys may be honest, the congressman suggested, "but the public wouldn't believe it." Nothing was said about the fact that if they are not honest they stand today subject to criminal penalties. The policing job is not very big. There are about 100,000 officers on the retired lists, but only 1,426 have been hired by the seventy-two largest defense contractors, and only 251 of these are retired generals or admirals, if rank is what Mr. Hébert is concerned about.

The Riddle, The Answer

"You may not believe it, and obviously the people who run the Administration don't believe it, but the push-button day is here—'60, '61, '62, '63. So help me God, it is here," Tom Lanphier told the National Press Club, pursuing his one-man attack on our defense program. He was referring to the assumption that Russia is producing missiles with accuracy inferior to our own. This has been publicly attested within the past few weeks, and Mr. Lanphier holds that use of this assumption "is critically dangerous to our national defense." It is an assumption, he told the Club, "that nobody has the right to make in this day and age."

The angry man, which is what Tom Lanphier is these days, made no bones about where he places full responsibility. He said he considers President Eisenhower to be "mortal, fallible, and culpable, if he has not competently led us to this point in history. And I do not think he has."

He also contended that he is not the only man with this opinion.

He continued:

"There are many people in the sciences and in the defense industry and in government who agree. . . . Not too many feel they can speak out about it. Those who do experience varied reactions. Outspoken critics in the defense industry are labeled munitions mongers and are discredited as self-serving. Critics from the Congress are dismissed as partisan.

"Critics in uniform, like Generals Ridgway, Gavin, Medaris, Taylor, and perhaps Admiral Carney, find themselves undecorated casualties of a war their fellow-citizens don't even recognize. And officers like LeMay, Hayward, Schriever, and Power, while not yet casualties, certainly must be listed among the walking wounded.

"What the form of rejection may be of intramural critics like Robert Lovett, Robert Sprague, Thomas Watson, and Dr. James Baxter is not yet apparent."

Then came the key question:

"If men such as these are dismissed as authoritative critics in the defense area, who *is* to criticize in this area? And to whom *does* the President look for guidance?"

Later, there were some questions and answers, according to the usual Press Club ritual. It was then that Mr. Lanphier provided his own reply for this rhetorical question. "Do you think the Director of the Budget should be unified with the Secretary of Defense?", a reporter wanted to know. The answer: "He already is!"

That is why the critics cannot be heard.

(Continued on page 21)

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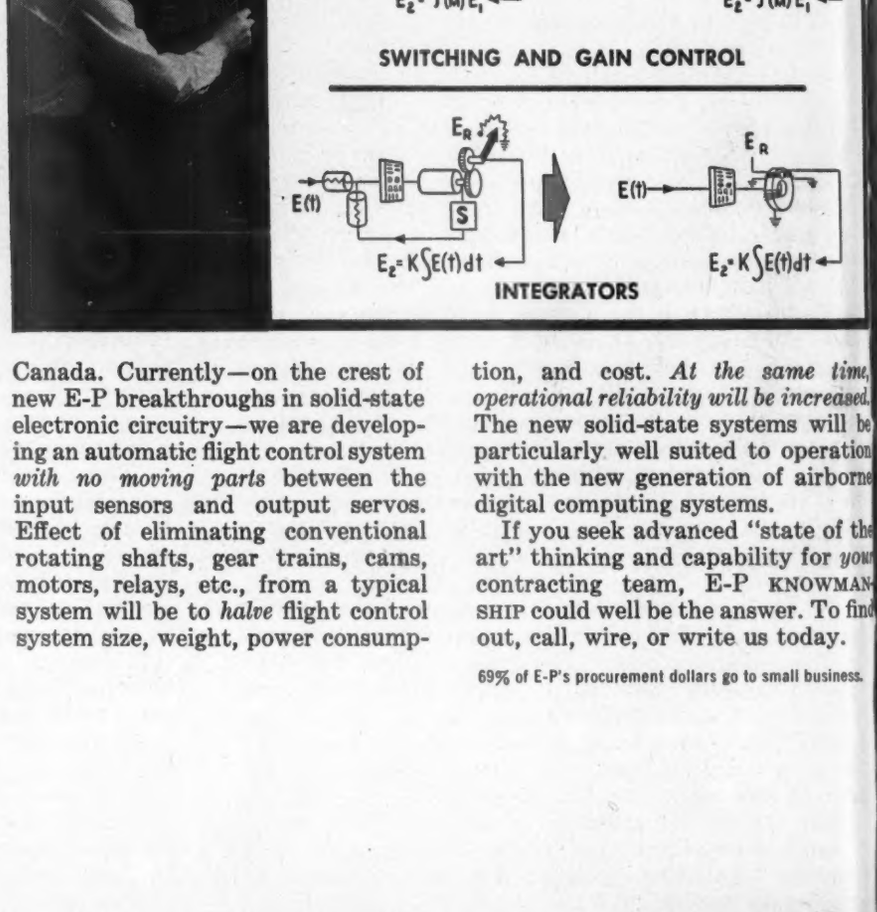
Knowmanship scoring breakthroughs in solid-state electronics



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Take automatic flight control systems. In 1954, E-P flew the first successful, fully-transistorized system—forerunner of models now flying or ordered for 34 different airlines of the world, as well as the air forces and navies of the United States and Canada. Currently—on the crest of new E-P breakthroughs in solid-state electronic circuitry—we are developing an automatic flight control system *with no moving parts* between the input sensors and output servos. Effect of eliminating conventional rotating shafts, gear trains, cams, motors, relays, etc., from a typical system will be to *halve* flight control system size, weight, power consumption, and cost. *At the same time, operational reliability will be increased.* The new solid-state systems will be particularly well suited to operation with the new generation of airborne digital computing systems.

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The Risk Remains

Any way you look at it, the last-minute USAF budget changes are going to increase the risk taken by the United States. The program for defense against the manned bomber threat has been cut back in order to try filling part of the missile gap and meet the Soviet ICBM menace. Basically, the Bomarc B ground-to-air missile and the SAGE ground environment system are the victims—they lost about $500 million.

More money is going into space, particularly Midas and Samos, the satellite projects which have been described as urgent.

The Atlas ICBM will get an additional $90 million in fiscal 1960 and $136 million in fiscal 1961. The retained manned interceptor force will get improved electronic equipment and weapons for air combat.

There were some special hearings on this subject before the House Subcommittee on Defense Appropriations in late March. For all of their emphasis on the ICBM threat that lies ahead, they still do not disguise any other equally horrible dangers. One USAF witness indicated that the capability to throw out electronic countermeasures is becoming more and more critical. It was clear that existing radar equipment needs modernization or replacement and that the modernization effort has not been too successful. It also was suggested that the potential enemy has not been asleep, and new electronic barriers lie ahead for both our offensive and defensive forces. Countermeasures for countermeasures have become a must, and they can't be the result of a sloppy effort.

At another point, a couple of moments before the hearing was taken off the record, a congressman disclosed that he sensed "new apprehension" about the threat of Soviet bombers. It would not take too well educated a guess to conclude that USAF has warned that the Red manned bomber threat still exists and will for a while to come. At the same time, there are political facts of life, and critics of the Administration do a lot of harping these days about the menace that lies around the corner. It is the menace of Red ICBMs.

Gen. Thomas D. White, USAF Chief of Staff, took cognizance of the shifting technology and the opinions of the responsible commanders. He said Gen. Laurence S. Kuter, NORAD Commander in Chief, does not agree with the new program. Then, this point:

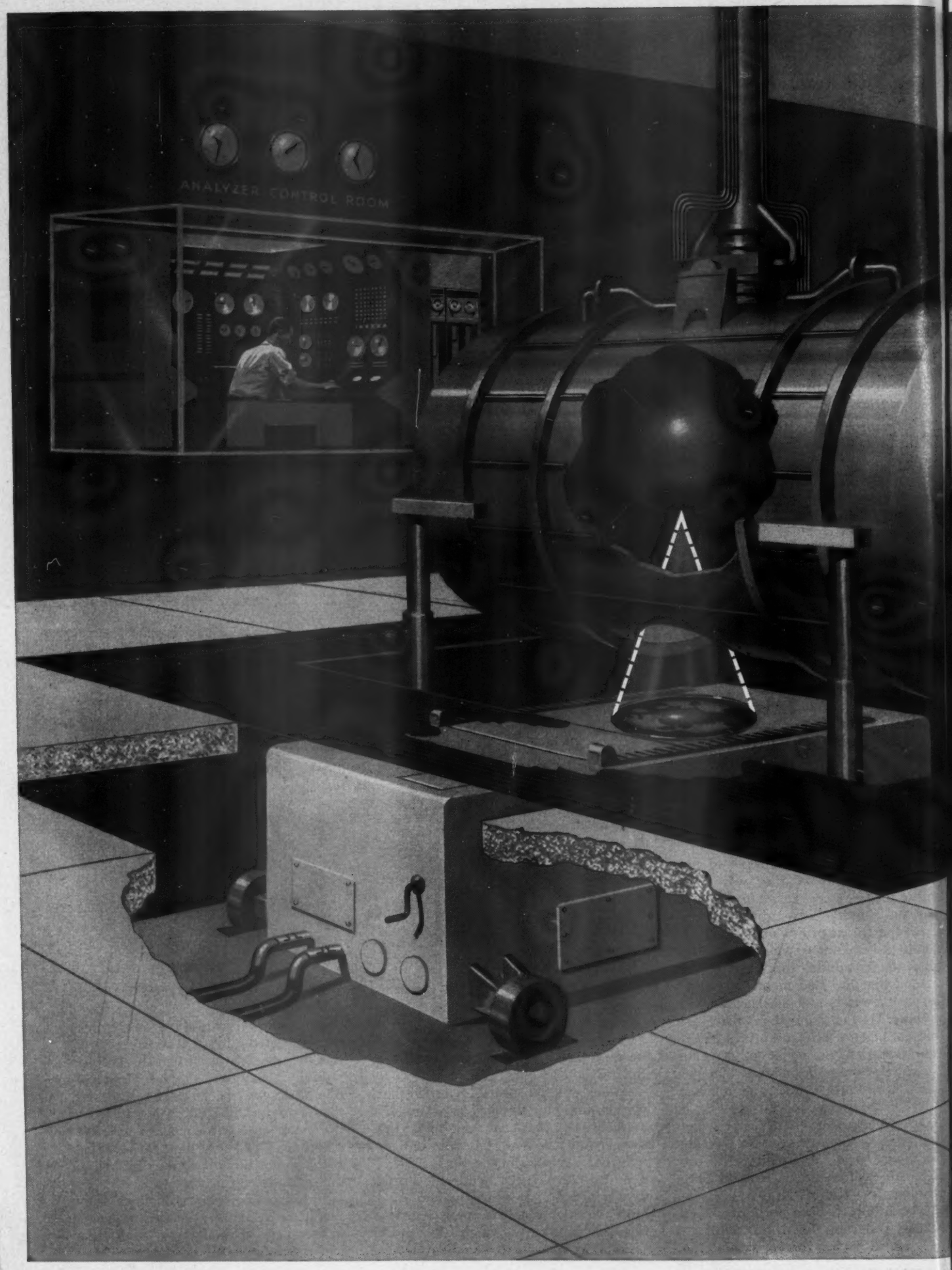
"We are trying here, within the President's budget, to shift our emphasis to give us a good air defense earlier than we would have had it and to put some of the moneys on systems which will better meet the future. . . ."

There was no effort to imply that we stand in no danger of attack by manned bombers or even that the danger has lessened. The only danger reflected is that of exceeding the expenditure level laid down in the President's budget. It was pointed out, quite bluntly, that the total of additional expenditures sought for more distant weapon systems adds up to well within the savings contemplated.

A month earlier, USAF took an opportunity to educate the House group on some of the more ethereal facts of budget life. It was put in the record, potently, that the whole business of operating under "guidelines" set by the Defense Department is a pain in the neck and a menace to sensible planning. USAF put together its fiscal 1961 budget about six months before the guidelines were received.

If there must be guidelines they should be available at least three years in advance. Without this, other risks will rise to imperil the nation.—END

SPEED AND SAFETY—FOR LESS—IN CESSNA U-3A. Faster than many larger utility transports, the Cessna U-3A is more *agile* as well. Outstanding flight characteristics (power loading, acceleration, rate of climb) enable it to come and go—with twin-engine safety—where larger transports can't. The U-3A is notably economical, too. Low in initial as well as operation and upkeep cost, it delivers its speed-with-safety at impressive savings for the Air Force.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Honeywell Dynamic Analyzer recreates authentic shoot environment, pinpoints design deficiencies

The Honeywell Dynamic Analyzer will simulate actual flight conditions from sea level to extremely high altitudes which affect performance and reliability of aerospace systems. An integrated test facility, it brings together for the first time most of the conditions and phenomena that cause aerospace system breakdowns.

It will be independent of the weather, the availability of test vehicles and flight variables. And in many cases, the test data will be more reliable and valid than can be attained in flight testing.

Areas of application include: reconnaissance, guidance, power supply, and communication systems. Tests of complex systems which now might require more than a year to accomplish, will be telescoped down to several weeks. It will be possible to determine which operating systems are detracting from overall performance, and to what degree.

The first Dynamic Analyzer was conceived under the direction of the Aerial Reconnaissance Laboratory of the Wright Air Development Division, USAF. There, the fully instrumented analyzer will be housed in its own building. Capabilities include: high vacuum, high and low temperatures; three-directional vibration; roll, pitch and yaw motion; buffeting; rotation; target variations; controlled ground speed; reflected and transmitted signals.

Honeywell was awarded the prime contract to develop and produce the analyzer on the basis of strong research and development capability. If you have problems in analysis, test or simulation, consider Honeywell's broad experience. Telephone or write: Honeywell, Military Products Group, Minneapolis 8, Minn.

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News,
Views
& Comments

AEROSPACE WORLD

Frederic M. Philips
ASSOCIATE EDITOR

Down, out of a bright spring sky, a transonic bomber plummets toward a packed schoolhouse.

A second jet bursts into flames and disintegrates over a sleeping city, showering down a hundred tons of fiery wreckage.

Scenes from a nightmare? Yes—but also, unfortunately, events that took place at Denton, Md., and Little Rock, Ark., last month.

The Denton school narrowly escaped grisly tragedy when a disabled B-57 fell on it March 22. The plane grazed the roof of the building, shattering several windows, and plunged into a small dwelling nearby. The occupants, a middle-aged woman and her two young grandchildren, were killed.

Some 600 youngsters sat at their desks in the school. Except for a few who suffered minor cuts from flying glass, they escaped unharmed.

Pilot of the twin-jet light bomber, on an acceptance check flight from the Martin Company airport at Baltimore, was found a half mile from the scene of the crash, still strapped in his ejection seat and suffering from shock, a fractured pelvis, and a compound fracture of the left leg.

Nine days later, death struck at dawn in Little Rock. A six-engine B-47 medium bomber burned and exploded. The wreckage, much of it aflame, set strings of close-packed houses on fire, damaged others, and temporarily knocked out an electric power transmission line serving thousands of families.

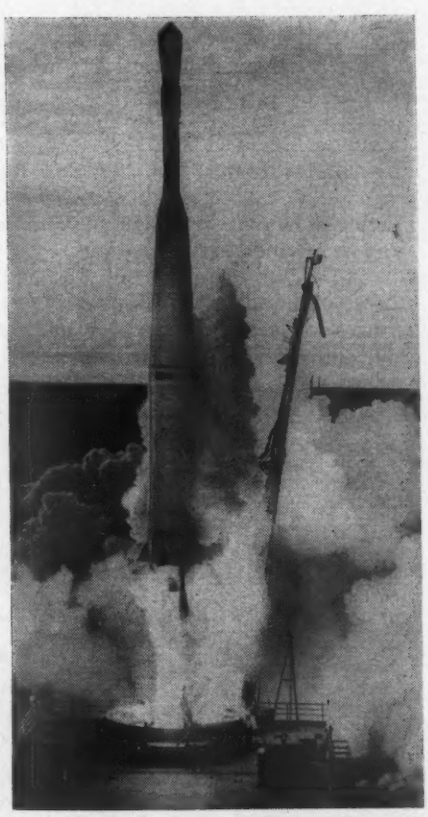
Killed by falling debris were two residents, an elderly woman and a young man. Three members of the stricken plane's crew also met their deaths. A fourth, the copilot, parachuted to safety in a badly burned condition.

The accidents underlined yet again the facts of life and death that have been a part of the airpower picture since the nation's first flying officer, Lt. Thomas A. Selfridge, was himself killed in a crackup, in 1908.

At the same time, however, accident-rate figures tell a contrasting story of their own. The Air Force, through a concerted attack on the problem, has been cutting this rate year after year. In 1959, there were only 8.3 accidents per 100,000 USAF flying hours, an all-time low. In 1958, the figure stood at 10.4. In 1957, it was 11.9. Over the past ten years, the rate has been sliced by more than three-quarters.

Late last year, USAF created a new office to bear direct responsibility for accident prevention throughout the entire service—in nuclear, missile, ground, and flight operations. Heading this organization is energetic and determined Maj. Gen. Joseph D. Caldara, Deputy Inspector General for Safety.

General Caldara noted realistically some weeks ago that "safety is relative" and even under optimum conditions "does not mean complete freedom from danger." But, he declared, so far as USAF is concerned "the only irreducible rate for accidents and fatalities is zero."



Thor-Able booster lifts off with Tiros I payload in April 1 launch of world's first weather satellite.

☆

The Air Force made a hard choice last month.

USAF recommended, and DoD and the Administration approved, far-reaching modifications in its program for the coming fiscal year. Primary aim was to beef up the deterrent and increase US missile-warning capabilities. Cut back would be long-term development of defenses against bomber attack – primarily to save money, taking a calculated risk that missile attack is the greater long-term threat. At the same time, bomber defenses for the short-term future would be slightly strengthened.

The USAF proposal included these points:

★ Stepped-up Atlas missile production.

★ Accelerated development of Midas missile-warning satellites.

★ A quickened pace in BMEWS construction.

★ Improvement of current fighter-interceptor types and items of their armament.

★ More expeditious development of the Minuteman ICBM.

★ A substantial cut in the Bomarc B antiaircraft-missile program and can-

(Continued on page 27)

The only operational cartridge starter...

SPECIFICATIONS:

Output shaft speed	3000 rpm (max)
Dry weight (not including cartridge)	60.0 lbs (approx)
CARTRIDGE STARTING	
Operating temp.	—65° to 160°F
Chamber pressure normal operation	850 psi
Safety plug diaphragm burst pressure	2000 psig (nominal)
Operating voltage	15 to 32 volts
PNEUMATIC STARTING	
Operating air pressure and temp.	50 psia and 350°F (nominal)
Operating air flow	100 lbs per min (approx)

AIRESEARCH'S CARTRIDGE/PNEUMATIC STARTER *has completed more than 20,000 successful cartridge starts for the F-100, F-105 and Hound Dog missile applications.*

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The starter consists, basically, of an air turbine starter and a removable solid propellant cartridge chamber. Combustion of the cartridge directs high pressure gas against the turbine wheel, turning the output shaft. Overspeed is controlled by aerodynamic braking action of air compressed by radial blades on the other side of the turbine wheel.

This simple system consists of proven components with many thousands of hours of successful operating history. The pioneer and leading manufacturer of air turbine starters of all types for both military and commercial application, AiResearch has more than four years of cartridge experience and 12 years' experience in pneumatic starters.

Your inquiries are invited.

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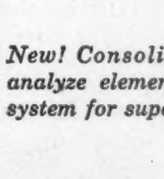
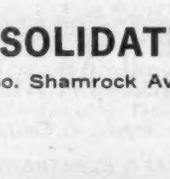
Systems and Components for: AIRCRAFT, MISSILE, SPACECRAFT, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

Test control and data processing systems used for rocket and missile testing and designed as a single concept... Bulletin 3022-X6.

Automatic data recording and processing system now being used in tests of the new hydrogen rocket engine... Bulletin 3012-X7.



Airborne, transistorized system for vibration monitoring of turbine engines... Bulletin 3011-X6.



Rocket fuel process control system for rapid data... Bulletin 3016-X5.

High speed data translator and editor system for processing jet air safety data... Bulletin 3021-X7.

Missile ground support system for countdown and pre-countdown checkout... Bulletin 3017-X7.

These technical brochures describe systems developed for the space age by Consolidated Systems Corporation. All are operating systems...on the job today...producing data in space age applications where time and performance are critical.

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New! Consolidated's mass spectrometers designed to analyze elements in outer space... ground data logging system for supersonic aircraft. Write for full information.

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cellation of construction of Super SAGE combat centers. The shorter-range Bomarc A and basic SAGE programs were not involved. Developmen of Bomarc B had already undergone somewhat rougher technological going than expected. Bomarc A is operational. In doubt once more, also, appeared to be construction of an underground NORAD combat center in Colorado.

DoD incorporated Navy provisions with the USAF proposals. These would speed construction of Polaris submarines and cancel two antisub subs. The entire bundle went to Congress during the second week in April as revisions to the FY 1961 defense budget. It left the proposed budget's $41 billion total virtually unchanged, to no one's surprise.

Here was another rejiggering in the field of air defense, bringing to mind one commander's observation on the subject last year:

"If time would stand still, it would be simple."

☆

An F-106 has given aging barnstormers fresh cause to observe, "No, flying isn't what it used to be."

The delta-wing Convair interceptor performed a "look, no hands" flight across the country late in March. At the controls, but taking great pains not to touch them, was Maj. Frank Forsyth of AMC.

Major Forsyth (*see cut*) took off from Palmdale, Calif., shortly after breakfast on March 23. He climbed steeply over the field, then leaned off the controls, sat back, and relaxed. The plane proceeded to fly itself to Jacksonville, Fla., during the next three hours and seventeen minutes.

Key to the automatic cross-country hop was advanced electronic gadgetry. Specifically involved were the F-106's Hughes MA-1 navigation/fire-control system and tactical air navigation (TACAN) stations stretching across the continent.

Engineers preprogrammed the Palmdale-Jacksonville trip on the MA-1's computer—feeding in navigation, altitude, and fuel data. The TACAN stations continually flashed range and bearing information to the speeding plane. The navigation/fire-control system automatically compared this actual flight data with the preprogrammed material. Where indicated, the system then corrected aircraft heading and altitude—or, to put it another way, flew the plane.

How did Forsyth spend his time? "It was like riding in the back seat of a limousine with a TV set and someone else doing the driving," he told newsmen. "All I did was flick a couple of dials to set up new maps on the horizontal situation indicator screen as we passed from one TACAN station to another. It was like switching from one TV channel to another."

Air Materiel Command's Maj. Frank Forsyth and the Hughes MA-1 electronic black boxes that "flew" him and a Convair F-106 Delta Dart fighter across nation in 2,500-mile, "no-hands" hop at the end of March.

☆

"Air Force officers," says a top management consultant in Washington, "are better than they think they are as managers."

But, continues George Washington University dean-private consultant Joe L. Jessup, they and the industrial executives with whom they deal could do even better jobs if they took to heart one little word: communication.

Mr. Jessup, who ran a management program attended by hundreds of USAF generals and colonels from 1951 to 1957, and has since served extensively as a consultant to the armed forces and business concerns, declares:

"I'll take the best in the Air Force and stack them up against the best in industry, universities, or anywhere

(Continued on page 29)

USAF BOMARC Missile produced by Boeing Airplane Co
—equipped with TI-built PDM/FM/FM telemetry system.

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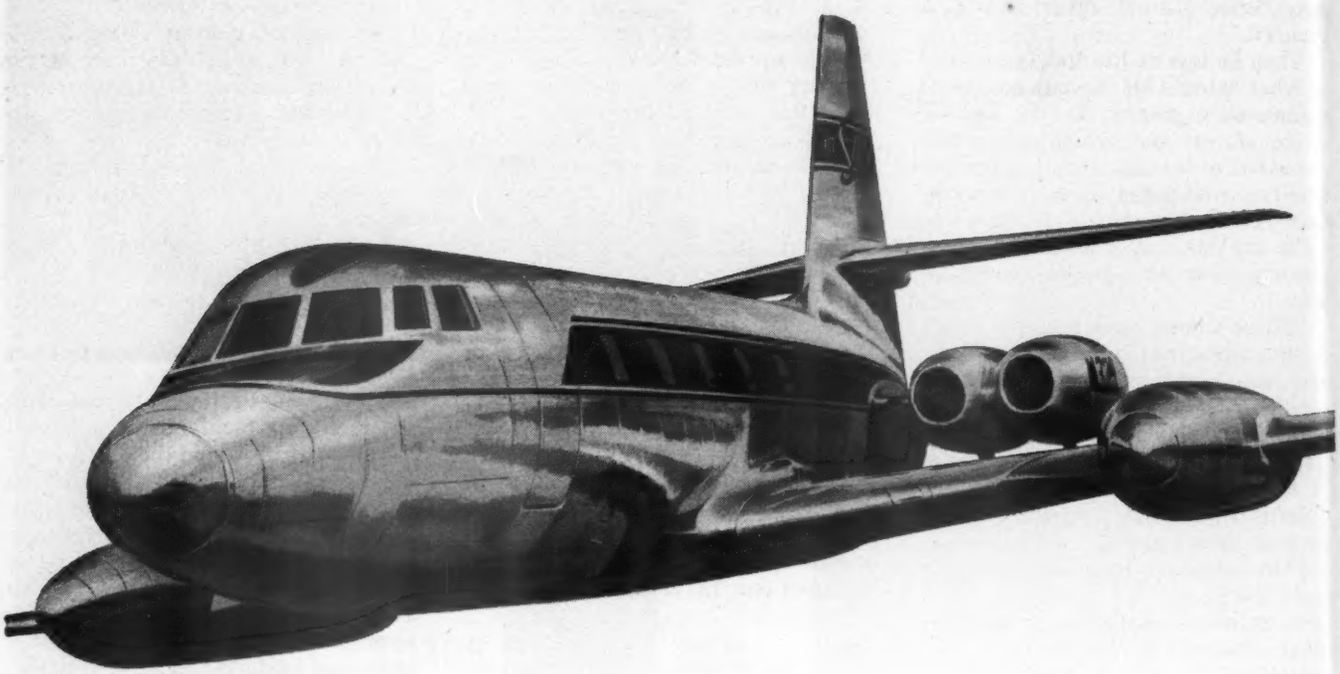

THE LOCKHEED T-40 JETSTAR PUTS JET PERFORMANCE IN TRAINING MISSIONS

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The Lockheed T-40 JetStar is ideally suited for airway and air-communications service, training navigators, bombardiers and Electronic Countermeasures crews. It provides an operational environment compatible with combat-type jet aircraft and releases commonly used combat-ready units. Completely qualified for transport and utility missions, the JetStar has intercontinental capabilities, yet can land at smaller airports. Four Pratt & Whitney Aircraft J-60 (JT12) engines power the JetStar. Weighing only 436 pounds but developing 3,000 pounds thrust, the J-60 is one of the most efficient powerplants ever developed. Its simple, rugged design insures high operational reliability and easy maintenance. And of course, like every Pratt & Whitney Aircraft engine, the J-60 is backed by Pratt & Whitney Aircraft's world-wide service.

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else. Air Force officers are better than they think they are as managers, and also better than I think is widely realized."

Then he lays on his desk forms used in what he calls his "seven-and-seven" management studies. In the studies, senior officers and civilian executives are asked to list the seven key responsibilities and duties of each subordinate. Each subordinate is asked to make up his own list of the seven primary tasks his superior expects of him.

"These studies have revealed a surprising amount of misdirected effort," Mr. Jessup explains. "In 1,000 higher-echelon boss-subordinate relationships studied in the Air Force and industry, we found a thirty percent lack of agreement on responsibilities and objectives. In some organizations, the percentage is higher.

"The obvious conclusion from this and other work done along the same lines is that in all too many management situations in the Air Force and elsewhere, there is a simple lack of communication. Seniors and subordinates should sit down regularly and discuss specific responsibilities and general objectives. Bosses, in plain terms, should spell out what they expect of those under them."

☆

Glenn Havens, a San Diego business executive, his wife, four sons, and a daughter dig the need for bomb shelters. So they dug—for a dozen years.

Today, a 500-foot tunnel leads down from their canyon-side home to a spacious nine-room subterranean shelter. Three of them are said to be "big enough for table-tennis tables."

It all began with a barbecue pit. The Havenses built one thirteen years ago. Then they turned it into a cave. Then, in the words of Mrs. Havens, "We kept digging."

The job done, they went on to fancy up the underground rooms to a considerable extent—paving the floors, putting in beams, installing fluorescent lighting.

Like others here and there through the nation, the Havens' shelter has a variety of peacetime uses. Most gratifying, say Mr. and Mrs. Havens, it is one of those rare spots that fits the description, "nice and quiet."

☆

★ **Red faces in Washington department.** USAF and Central Intelligence Agency officials in the nation's capital wore them for a few days last month. AIR FORCE/SPACE DIGEST and Senator Kenneth B. Keating of New York were the innocent agents of their embarrassment. The Republican legislator pinpointed Soviet missile production centers and launch sites in a statement in the Upper House. USAF and CIA representatives hurried to his office to ask one big question: Where did he secure this quite important intelligence material? The answer: In a report by Britain's Institute for Strategic Studies in the March issue of this magazine. Where else?

★ **Racetrack report (II).** Last issue AIR FORCE/SPACE DIGEST reported a sad day for airmen at Maryland's Bowie racing ground. Highly touted entrant Tooey Spaatz finished fifth in one race, Ira Eaker was scratched. In short, USAF horseplayers went home dragging their stabilizers.

A new chapter has now been added to this horsey tale. The horse Spaatz, named for USAF's first Chief of Staff, not only dashed to a victory one afternoon recently, but figured in a military-type daily double with a pony named Shining Armor. Sky Point won a later race—and nags with such sister-service monickers as Mr. Fleet, Fleet Home, and Queen of Battles did not fare nearly so well. So, after all, matters seem to be pretty well in hand—aerospacewise—at Bowie.

★ **Unglued glossary.** Helpful definitions from a list prepared at the Raytheon Company in Massachusetts:

Ionization. Smoothing process applied to wet wash.

Memory tube. A wedding ring.

Megacycle. Small Italian motor scooter.

Esaki diode. Verses read at a Japanese wake.

Semiconductor. Railway conductor under five feet two.

★ **Thought for the month**—or, a saw in the wind. A friend at ARDC's Arnold Engineering Development Center, Tenn., philosophizes:

"As we say down at the wind tunnel, it's an ill wind that results in erratic and nonrepeatable aerothermodynamic data and associated dynamic, high-response quantitative measurements of questionable validity."

☆

Elsewhere in the aerospace world:

The **Titan ICBM,** which has had its ups and downs, was test-fired successfully twice this month. On March

(Continued on page 31)

N.A.S.A.'s Project MERCURY, first U.S. manned Space Capsule, built by McDonnell Aircraft.

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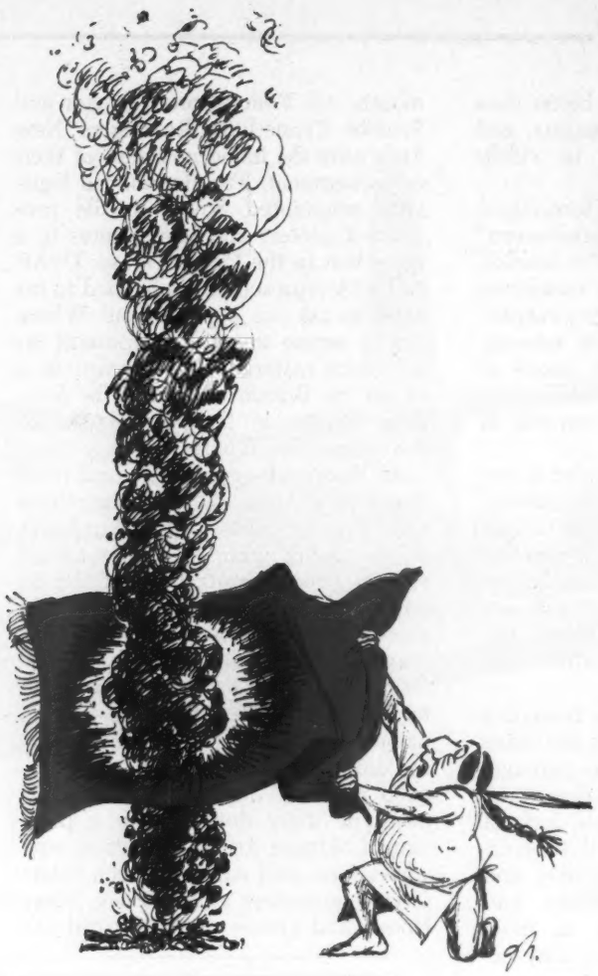
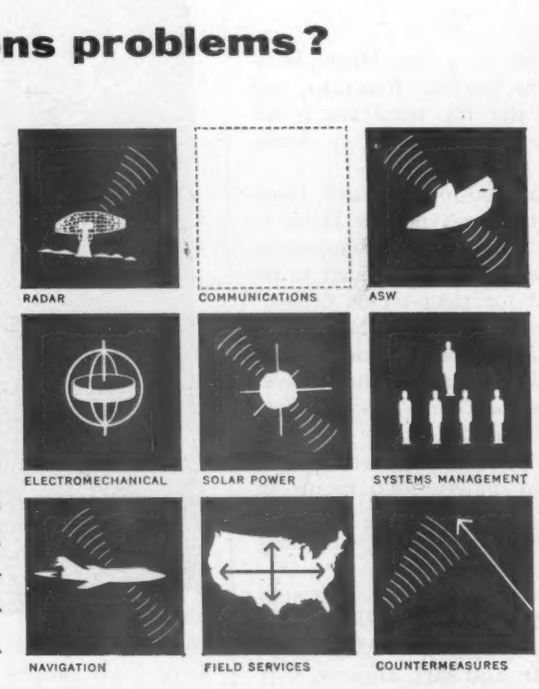


communications problems?

If an enemy should stage a surprise attack against the United States, our survival could depend on fast, reliable communications with command posts around the world. Hoffman has been a leader in the development and production of specialized communications equipment since the early days of World War II. Today, it is making significant contributions to some of the most advanced global communications systems employed by our military forces. With this experience, Hoffman stands ready to offer solutions to your communications problems.



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22, it whistled 5,000 miles down the South Atlantic Range; on April 8, 3,800 miles. On April 7, an **Atlas** blew up on its launch pad at Cape Canaveral, third explosion in two months for America's first operational ICBM.

A Boeing **Bomarc B** successfully test flew at Eglin AFB, Fla., April 13, first success in eight tries.

On March 23, **NASA** failed in an attempt to put a radiation-study satellite into orbit from the Cape. Stage three of the four-stage **Juno III** booster rocket did not ignite, so **Explorer VIII,** a 35.3-lb. instrument package, fell to a watery grave 2,000 miles out.

The first **Minuteman** site will be at **Malmstrom AFB, Mont.,** USAF announced on March 23, with construction slated to begin next January. Three Minuteman squadrons are to be stationed at Malmstrom, 500 men and an estimated twelve missiles to a squadron.

X-15 flight testing continued at Edwards AFB, Calif. Number two of the three X-15s underwent high-stress tests March 31. **Maj. Robert White,** Air Force test pilot assigned to the project, made his first X-15 flight on April 13. Previously, North American test pilot **Scott Crossfield** had done all X-15 jockeying.

France set off its second **atomic test blast** in the Sahara Desert on April 1. The first was on February 13. This second blast came as Soviet Premier Khrushchev conferred with French President de Gaulle in Paris, and as East and West continued discussions on outlawing nuclear testing.

On the first of April, also, NASA sent its **Tiros I** weather satellite coursing around the globe. A USAF **Thor-Able** booster shot it on its way. In orbit, the 270-pound, hatbox-shaped satellite went to work televisually. It began almost immediately to televise weather conditions and send back pictorial data from both sides of the Iron Curtain.

On April 13, the Navy successfully launched the world's first navigation satellite, **Transit I-B,** into orbit. Booster, once more, was a USAF Thor-Able. Transit I-B stood with Tiros I and **Pioneer V,** the solar-orbiting planetoid launched March 11, as solid US space achievements. As usual, the technological and operational support of USAF's **Ballistic Missile Division** and of **Space Technology Laboratories** went unsung in the press.

Two artificial satellites died on schedule during the month. Russia's **Sputnik III** fell into the atmosphere and disintegrated on April 6. USAF's **Discoverer VIII** went the same way on March 8.

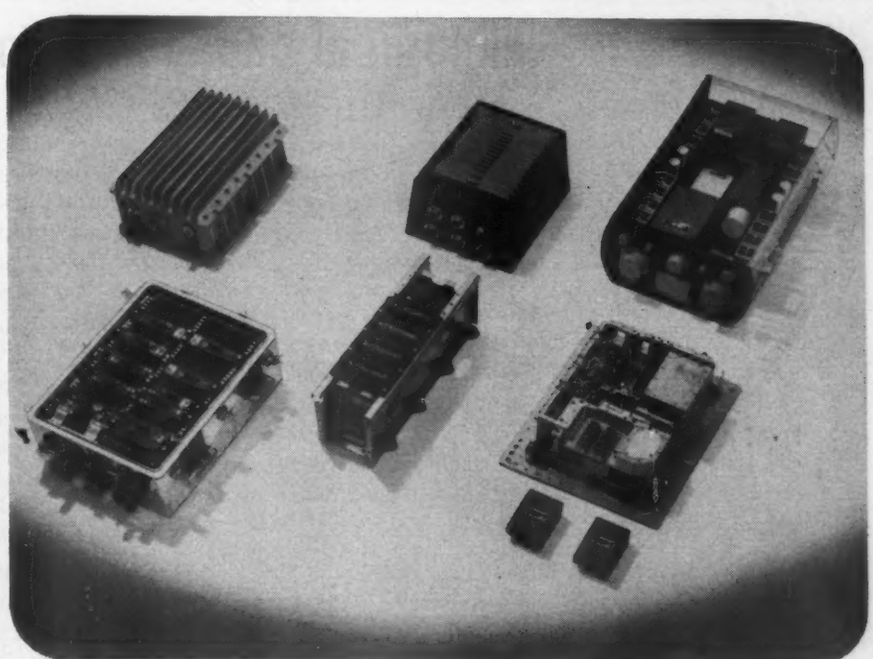
The US will sell Douglas **Skybolt ALBMs** to Britain when they are in production, the State Department announced on April 13 as the British made known a decision to cease development of their own missiles.

Lt. Gen. William H. Tunner, MATS Commander since 1958, associated with numerous airlift and transport operations during thirty-two years of service, retires this month or next, USAF announced April 6. His successor was not immediately named.

May 21 is Armed Forces Day. Many military installations will hold "Open House" for the public.

On May 15, a thirty-day fund drive to finance construction of an **Air Force Academy football stadium** comes to a close. The drive, among USAF and the public, is sponsored by the Air Force Academy Foundation.

(Continued on page 33)



TI telemetry developments for CENTAUR, MINUTEMAN, TITAN, PERSHING, BOMARC and Project MERCURY.

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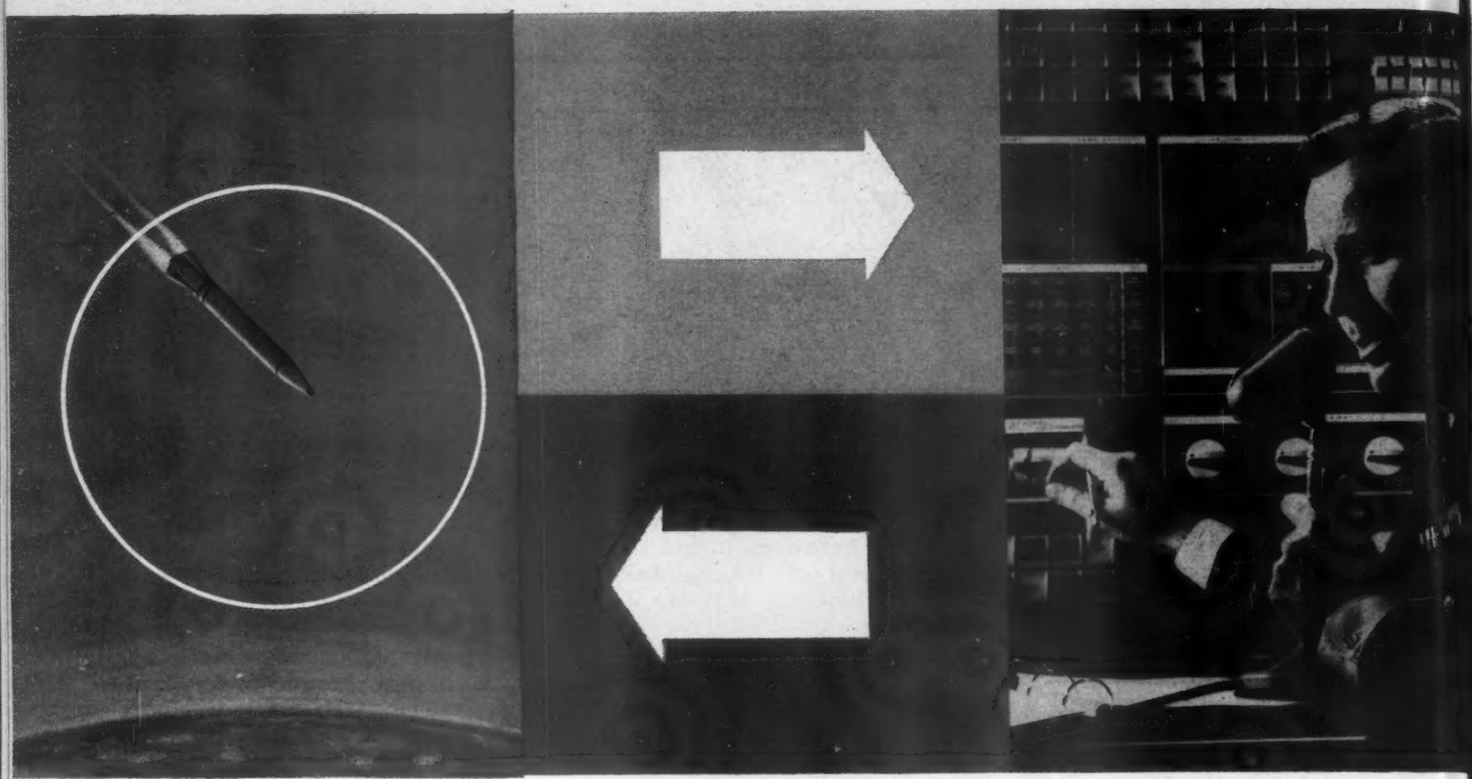

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STAFF CHANGES . . . Maj. Gen. Sam W. Agee, now Commander, 26th Air Division (SAGE), ADC, Hancock Field, N. Y., will become Director of Operations, DCS/Operations, Hq. USAF, on July 1 . . . **Maj. Gen. Cecil H. Childre,** who recently became Deputy for Operations, TAC, Langley AFB, Va., will assume duty as Assistant DCS/Plans and Programs, Hq. USAF, June 22 . . . Effective July 25, **Maj. Gen. Leo P. Dahl,** now Comptroller, AMC, Wright-Patterson AFB, Ohio, will become Commandant, Command and Staff College, Air University, Maxwell AFB, Ala. . . . **Maj. Gen. Leighton I. Davis,** now Assistant DCS/Development, Hq. USAF, will become Commander, AF Missile Test Center, ARDC, Patrick AFB, Cocoa, Fla. . . . **Brig. Gen. Joseph F. Delaney,** from DCS/Comptroller, MATS, Scott AFB, Ill., to Director of Accounting and Finance, AF Comptroller Hq. USAF, on July 1 . . . As of June 16, **Brig. Gen. John A. Dunning,** now at Hq. USAF, becomes Commander, 831st Air Division, TAC, George AFB, Calif.

Brig. Gen. George B. Greene, Jr., now CofS, ADC, Ent AFB, Colorado Springs, Colo., will be Deputy Commander, Hq. 17th AF, USAFE, APO 12, N. Y., effective July 22 . . . **Brig. Gen. Edgar W. Hampton,** formerly Deputy Commander, WESTAF, MATS, Travis AFB, Calif., is now Commander, 323d Division, MATS, same base . . . On July 23, **Brig. Gen. Edward J. Hopkins,** Commander, AFAFC, 3800 York St., Denver, Colo., will become Comptroller, Hq. AMC, Wright-Patterson AFB, Ohio . . . **Maj. Gen. Sam Maddux, Jr.,** who is now Senior Member, UN Command Military Armistice Commission, UNC, assumes duty as DCS/Plans and Operations, Pacific Command, FPO 128, San Francisco, at the end of May . . . Effective July 5, **Brig. Gen. Loren G. McCollom,** Vice Commander, Air Defense Systems Integration Division, ARDC, Laurence G. Hanscom Field, Mass., will become Commander, 4608th Support Squadron, ADC (Det. 4), same base.

Brig. Gen. Jerry D. Page, now DCS/Technical Training, ATC, Randolph AFB, Tex., will become Deputy Director for War Plans, DCS/Plans and Programs, Hq. USAF, effective June 16 . . . **Maj. Gen. Oliver S. Picher** is now Assistant to DCS/Personnel, Hq. USAF. He held the temporary rank of lieutenant general in his former post as Director, Joint Staff, Central Control Group, Hq. USAF . . . On July 1, **Brig. Gen. Harvard W. Powell,** Director, Procurement and Production, DCS/Materiel, Hq. USAF, will become Vice Commander, AFBMD, ARDC, Inglewood, Calif. . . . **Maj. Gen. Maurice A. Preston,** from Director of Operations, DCS/Operations, Hq. USAF, to Commander, 19th AF, TAC, Seymour-Johnson AFB, N. C., effective July 1 . . . **Maj. Gen. Romulus W. Puryear,** now DCS/Operations, ADC, Ent AFB, Colorado Springs, Colo., will be CofS, ADC, at the same base . . . **Brig. Gen. Allen W. Rigsby,** former Judge Advocate General, SAC, Offutt AFB, Neb., reassigned same duty, AMC, Wright-Patterson AFB, Ohio . . . **Brig. Gen. Kenneth O. Sanborn,** relieved from duty as Commander, 42d Air Division, SAC, McConnell AFB, Kan., and assigned as Commander, Air Task Force 13, Provisional, and Chief, AF Section, MAAG Taiwan, PACAF, APO 74, San Francisco, Calif., effective August 1 . . . **Brig. Gen. Paul W. Scheidecker,** Comptroller, ADC, Ent AFB, Colo., will become Commander, AFAFC.

Effective June 1, **Maj. Gen. Prescott M. Spicer,** Commander, Los Angeles Air Defense Sector, ADC, Norton AFB, Calif., assumes duty as Deputy Director of Programs, DCS/Plans and Programs, Hq. USAF . . . **Brig. Gen. Charles H. Terhune, Jr.,** Vice Commander, AFBMD, ARDC, Inglewood, Calif., becomes Vice Commander, AFCCDD, ARDC, Laurence G. Hanscom Field, Bedford, Mass., on July 1 . . . **Brig Gen. Frederick R. Terrell,** Commander, 64th Air Division (Def.) ADC, APO 862, N. Y., maintains same post with duty station Stewart AFB, N. Y., effective June 1 . . . On May 1, **Maj. Gen. Moody R. Tidwell, Jr.,** now Judge Advocate General, AMC, Wright-Patterson AFB, Ohio, will become Assistant Judge Advocate General, Office, TJAG, Hq. USAF . . . **Maj. Gen. Henry Viccellio,** now Commander, 19th AF, TAC, will become Commander, 26th Air Division (SAGE), ADC, Hancock Field, Syracuse, N. Y., with additional duty as Commander, 26th North American Air Defense (CONAD) Division, effective July 1 . . . **Maj. Gen. Benjamin J. Webster,** Director of Programs, DCS/Plans and Programs, Hq. USAF, becomes Deputy for Operations, ADC, Ent AFB, Colo., on August 22 . . . On August 17, **Brig. Gen. Robert F. Worden,** Deputy Director, J-5 (Plans), Hq. USAF, becomes CofS, US Taiwan Defense Command, Air Task Force 13, Provisional, PACAF . . . **Maj. Gen. Donald N. Yates,** Commander, AF Missile Test Center, becomes Deputy Director, Defense Research & Engineering (Ranges and Space Ground Support).

RETIRED . . . Maj. Gen. Reginald C. Harmon; Brig. Gen. Stoyte O. Ross; Brig. Gen. Llewellyn O. Ryan.—END

U. S. Army Signal Corps SWALLOW AN/USD-4 Combat Reconnaissance Drone
Produced by Republic Aviation—Equipped with TI Surveillance Sensors

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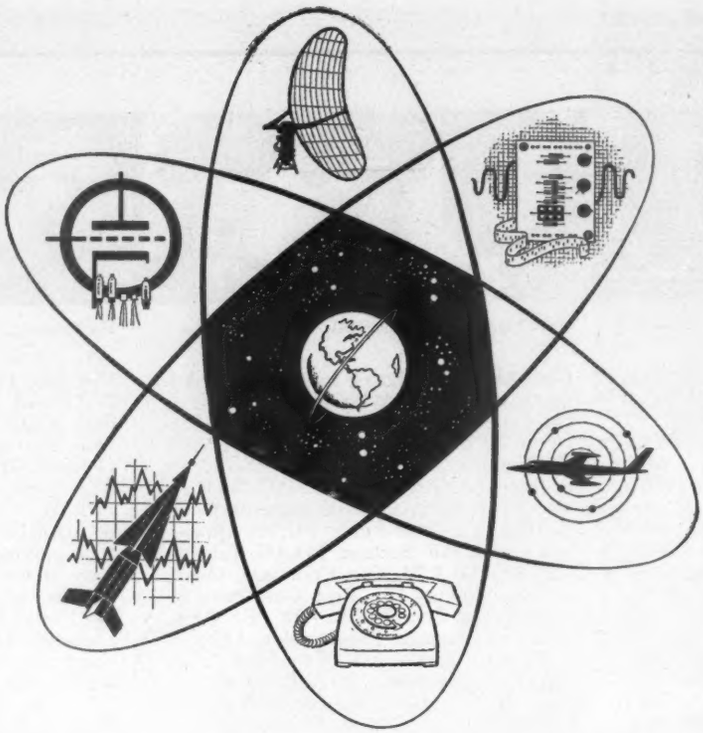

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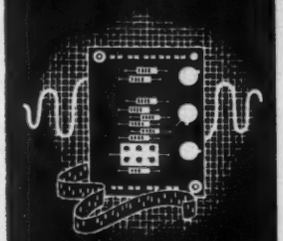
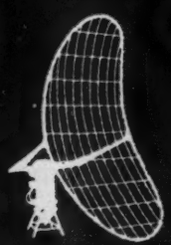


Data Processing and Display Systems

Sylvania leadership in digital data processing is typified by its most recent achievement: design and development of MOBIDIC. This solid state, mobile computer will give field armies real-time solutions to many intelligence and reconnaissance problems, almost instantaneous answers to operational problems involving logistics, inventory control, etc. Sylvania has also pioneered in developing electronically driven electroluminescent display equipments and systems. SYLVANIA ELECTRONIC SYSTEMS has subsystem management and development responsibility for the data processing portion of the Air Force BMEWS program, including new and advanced concepts of 3-dimensional data take-off circuitry and equipment.



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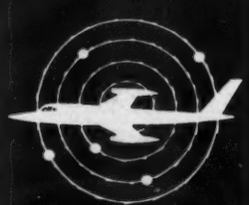
SYLVANIA ELECTRONIC SYSTEMS has an advanced capability in high resolution, electronically scanned radar. Example: Sylvania has management and development responsibility for the Army's AN/MPQ-32, a mobile artillery detection, tracking and fire control system.



Intelligence and Reconnaissance Systems

In recent years, Sylvania has developed many types of broadband ferret receivers, signal analyzers and sensing devices across the entire spectrum. Advanced anti-intrusion devices are now under development. The Air Force AN/GLR-4 program represents the type of programs in this area for which Sylvania has development and management responsibility.

Electronic Warfare Systems

Sylvania leadership in electronic warfare is typified by its advances in countermeasures and counter-countermeasures against all known types of electromagnetic radiation. Sylvania manages the passive defense system for the B-58, and maintains a quick-reaction capability and facility for Army ground-based electronic warfare activities.

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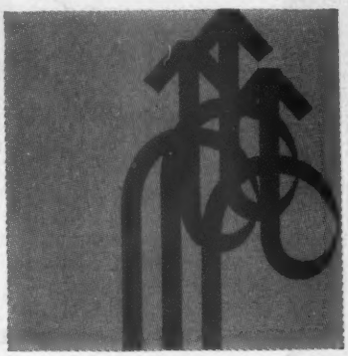

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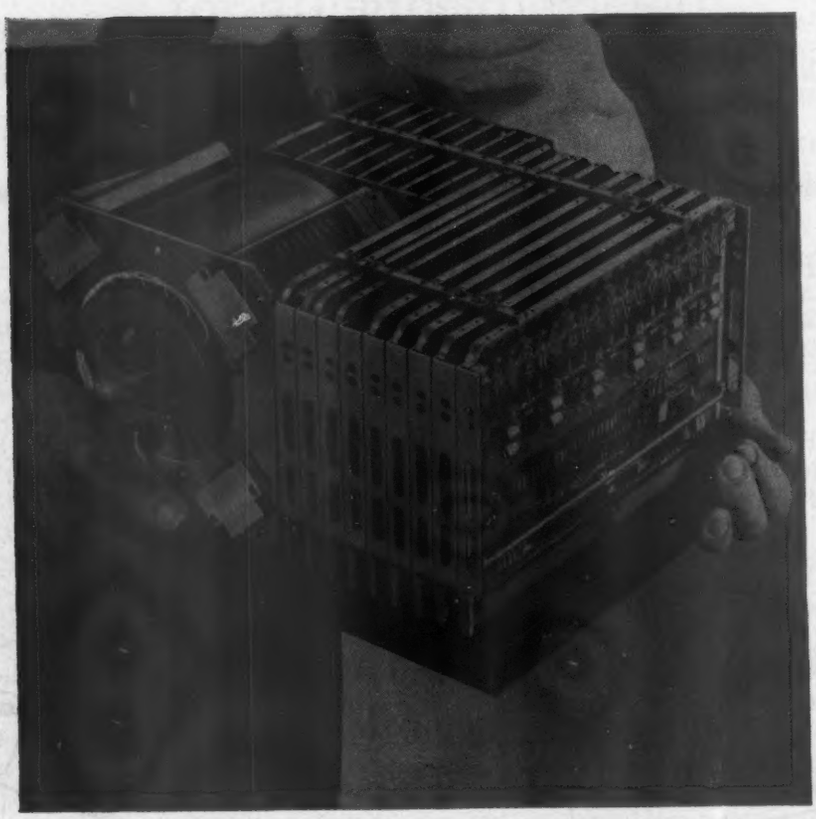

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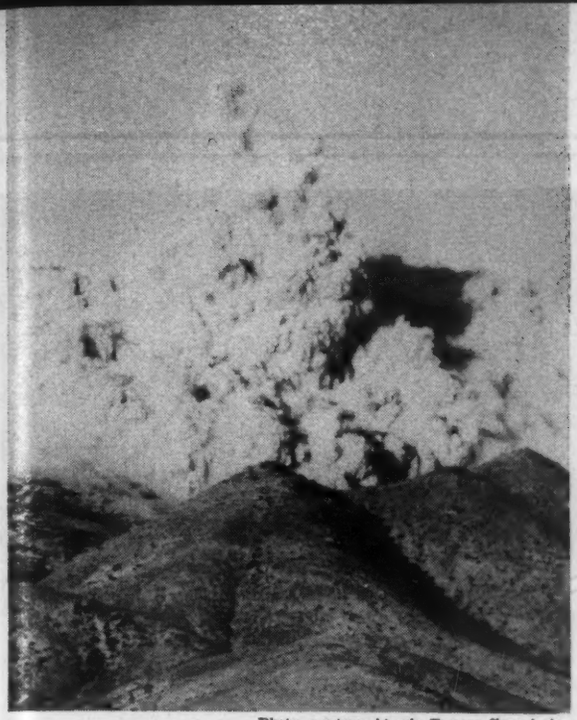


Photo courtesy Atomic Energy Commission

Underground nuclear blast in Nevada late in 1958.

AIR FORCE
MAY 1960

- **East and West may be on the verge of an agreement to ban all nuclear experiments, including underground test shots.**
- **Both we and the Soviets know that subterranean shots, up to 20-kiloton yields, cannot be detected with certainty, even by on-site inspection.**
- **The US would not cheat during a test suspension, even though our continued development of modern weapons would be curtailed and our programs for peaceful application of nuclear power would be hampered.**
- **We would have no real assurance that the Soviets were not conducting secret subterranean tests, no proof even if we believed they were doing so.**
- **Clear-cut evidence, little of which has been placed before the American public, indicates that a complete test ban now would not only be unrealistic but could prove calamitous to the free world . . .**

Can We Live With A NUCLEAR TEST BAN?

Earl H. Voss

PRESIDENT Eisenhower has indicated that he expects his mid-May summit meeting with Soviet Premier Khrushchev to advance significantly the prospects for a three-power treaty to ban nuclear weapons testing—some types for all time, others for an interim period that could be extended if detection techniques improved.

Not enough people know, however, that at present there is actually no reasonable hope of reaching *safe* agreement, even should the Soviet Union agree to an international test-ban treaty with a built-in policing provision.

The public has not been clearly warned, for instance, of clear-cut evidence that the Soviet Union not only could but probably would cheat on any moratorium, declared by treaty or not. How many know, for instance, that the Russians have been experimenting with concealment of underground explosions, using the very American "big-hole" theory which they publicly deride?

The people have not been warned, either, of the ineffectiveness of the inspection system the West is pressing the Soviet Union to accept in Geneva negotiations. How many know that American experts consider the long-sought "on-site inspections" for the checking of suspicious underground shocks to be virtually useless? And the Russians have been chary even of these.

As a result of failure by American officials to spread the alarm, worldwide pressure is still on for what would be an exceedingly dangerous, perhaps fatal, moratorium on nuclear-weapons tests.

The ban could be fatal because the Soviet Union could continue with its own weapons development by secretly testing underground, while United States weapons development would be arrested in its open-society environment.

It would then be only a matter of time until the Soviet Union could overtake the United States' presumed lead in nuclear-weapons development. The Kremlin could then put together a fatal combination of the world's best warheads with highly accurate rockets.

In the absence of warning about these grim realities, the United Nations has passed well-meaning resolutions against nuclear tests. The United States would be defying these resolutions if it resumed testing to preserve its own—and the world's—security. World sentiment already is inhibiting the United States, which has not tested for a year and a half.

The Soviet Union has promised not to test unless the West does. But for all we know Moscow could be secretly testing underground right now, with nuclear weapons as powerful as the one that leveled Hiroshima. There is even an outside possibility that the Russians could test a weapon fifteen times as powerful as the Hiroshima A-bomb without detection.

In the meantime diplomatic jockeying, which sometimes seems far removed from nuclear realities, goes on.

(Continued on following page)

Geneva, 1958. Technical experts from East and West during first international conference on the detection of nuclear testing. Western delegates are at right of table, Soviets at left. This meeting had limited success in bringing together scientific data, laying groundwork for further talks. Russians "behaved like scientists" in objective discussions. Second experts' conference at Geneva last year was, in contrast, scene of dramatic, bitter exchanges with Red scientists.

President Eisenhower and British Prime Minister Macmillan went to Camp David in Maryland late in March to compose their latest offer to the Soviet Union. They agreed to the desirability of a long-term ban on all detectable tests and accepted a Soviet-proposed short-term ban on undetectable tests while methods of improving detection are studied.

But they did not make clear that the undetectable area in which the moratorium would apply is so large that development of any still-needed nuclear weapons could be carried on by an unscrupulous power quite comfortably, underground, without reasonable hope that inspectors could prove a violation.

In big underground caverns, tests of weapons at least five times as powerful as the Hiroshima A-bomb could be made with no chance of detection.

In any tunnel dug deeply enough, nuclear tests up to twenty kilotons, the equivalent of 20,000 tons of TNT, could be held without likelihood of detection.

There is equally discouraging evidence that, even were a possible underground treaty violation spotted, the odds would be hopelessly against proving the shock was a nuclear explosion rather than an earthquake.

The United States is, in other words, pressing the Soviet Union to accept an on-site inspection system that would be substantially impotent.

The Soviet Union has recently come around to permitting almost any suspicious underground disturbance to be investigated on the site, but she still insists that only "a few" of these can be inspected each year.

Leo Szilard, physicist who helped talk Einstein into writing the famous atomic bomb letter to President Roosevelt, has suggested in The Bulletin of the Atomic Scientists *that we increase the number of inspections allowed by offering to pay the Soviet Union "a few million dollars" per inspection. Dr. Szilard points out that "there would be no need for Russia to limit the number of expeditions on her territory; the Bureau of the Budget presumably would limit the number of such expeditions."*—The Editors

There would be from 7,500 to 30,000 earthquakes a year that looked enough like nuclear tests to be eligible for inspection, according to the most precise estimates possible in the present state of the seismic art. Inspecting only a few of these could not possibly be expected to deter a would-be cheater nation, even if the on-site method were effective.

In fact, the United States is officially on record before Soviet scientists that the method is not effective.

Dr. James Brown Fisk, the chairman of the American group of scientists who discussed underground-test inspection with Soviet experts behind closed doors at Geneva late last year, told them the United States considered on-site inspection all but useless.

Here are his words, from the official transcript:

"If it were ever the purpose of a violator to attempt to hide such an event [as an underground nuclear test] the task of an on-site inspection group might be so great and so difficult that the probability of success would be close to zero."

No American official has ever advanced this judgment publicly. Weeks after the November 25-December 19 conference, the voluminous transcript was quietly made available for anyone who asked to see it.

An insight into the reasoning behind Dr. Fisk's surprising conclusion was provided by Dr. Hans Bethe of Cornell University, one of the leaders of that part of the American scientific community most eager for a test ban. In one of the frequent acid exchanges that marked the meeting of Soviet, American, and British scientists in Geneva, Professor Bethe was stung by a typical example of the Soviet delegation's unscientific exaggerations.

Dr. Yevgeni K. Fedorov, fat-cheeked and gesticulating, advanced the ridiculous claim that the first East-West experts' meeting in 1958 had agreed that "deep underground explosions will *always* be detected . . . with the help of inspection."

The radioactive debris produced by a subterranean shot would be sealed into its cavity for years, and could be tapped with oil-drilling rigs, he said.

"In certain cases we need more time and in other cases less time" to find the pocket, he acknowledged, but the method was bound to be foolproof if the inspectors kept probing long enough.

Professor Bethe recalled that the Nevada underground blast known as Rainier, exploded in September 1957, had been the equivalent in power of 1,700 tons of TNT, or 1.7 kilotons, and had produced a debris-filled cavity of fifty-five feet in radius.

"If my arithmetic is correct," the Cornell scientist snapped, "and if the area in which the seismic evidence locates the explosion is 100 square kilometers, this requires 500,000 drillings, each taking a month or so. I believe your delegation will permit two or three inspectors to go to the place, so we can calculate how long it will take them."

Dr. Bethe did not finish the arithmetic. If he had, he could have shown that one on-site inspection team could work 41,666 years before covering the 100-square-kilometer area.

Assume the absurd, that the Russians could somehow be persuaded to permit 1,000 drilling teams to pierce the Iron Curtain and comb the 100-square-kilometer area. Even such a brigade could be tied up more than forty-one years checking out one suspicious event. If the area under suspicion could not be narrowed to less than 200 square kilometers, the maximum envisioned by the Geneva experts' conference of 1958, the process could take more than eighty years.

To carry the arithmetic out the window: There would be 7,500 to 30,000 suspicious earthquakes each year. A test-ban violator would hope his secret underground explosion would be lost among these natural events. If one out of five of these shocks were to be checked, American officials reasoned in 1958, a would-be cheater probably would not risk being caught.

A twenty percent sampling would provide enough of a deterrent, in other words, to make a ban "effective."

This would require 1,500 to 6,000 investigations of underground events to be started each year, if an effective deterrent is to be provided. The mythical thousand inspection teams would then be occupied for 60,000 to 240,000 years checking out just the first year's batch of suspicious shocks.

Simple arithmetic thus is sufficient to dramatize the hopelessness of the on-site inspection technique which American negotiators still are pressing for in Geneva. Actually, of course, Dr. Fisk's statement on probabilities of catching a cheater is based on a more sophisticated calculation using higher mathematics.

There were other momentous goings-on at the second conference of Geneva experts.

- The Russians tried to get the Americans to rig seismic readings to prove that detection of secret explosions would be no more difficult, in fact less difficult, than originally calculated. Actually, Nevada underground experiments in October 1958 had shown it would be much more difficult than originally calculated.
- The Russians proposed criteria for the dispatch of on-site inspection teams which would have put impossible hobbles on the control system.
- They made a dramatic attempt to disprove American theories for hiding underground shots in "big holes," going so far as to disclose they themselves had been experimenting with the theory. There was no way of telling, of course, whether the Russians told all they found out, or all they have been doing.

Until these meetings late last year, Soviet science was widely assumed to have undergone a change since the days of Stalin. The first convocation of East-West scientists to study the nuclear-test-detection problem, in the summer of 1958, had been a happy occasion in which Russian scientists behaved more or less like other scientists, apparently basing their contentions on provable data. The two previous Geneva atoms-for-peace conferences had led Western scientists to expect the same objectivity from their Russian colleagues as they prided themselves on.

Science, the theory went, had become an international language like music, immune to Communist subversion. The second experts' conference at Geneva late in 1959 destroyed the theory, however.

President Eisenhower, complained the Soviet scientists, had been "politically guided." But he did not give the world his corroborating evidence, or dramatize the importance of this judgment. The image of repute which Soviet scientists had gained earlier and had bolstered with their boxcar-sized Sputniks still prevails.

In fact, the President and Prime Minister Macmillan have recently themselves helped to restore the Soviet politico-scientists' dignity by proposing a joint research program to extend effective detection so that it can cover muffled shots and those in the lower ranges underground.

In August 1958, when the experts of East and West devised their 180-station control system for detecting nuclear tests, there had been only one underground nuclear explosion on which to calculate requirements

(Continued on following page)

Photo courtesy United Nations

Geneva, 1960. US delegates seated at current ten-nation disarmament conference, held against background of new East-West nuclear-ban bargaining. Left to right, Charles Stelle, chief negotiator Frederick M. Eaton, Paul Dudley.

for a comprehensive system. All the scientists acknowledged the foundation for the system was not sound, but they were under pressure from the diplomats and politicians to do the best they could—anything to arrest the nuclear-arms race.

Communists and non-Communist scientists agreed that the 180-station network would be effective if it were supplemented by on-site inspections.

There would be twenty to 100 unidentified explosions, above five kilotons, around the world each year, the scientists calculated. These would be eligible for on-the-spot inspection. They could be pinpointed to an area between 100 and 200 square kilometers.

Two months after the agreement was reached, however, the United States conducted its Hardtack II series of five additional underground nuclear tests in Nevada. On-site inspection teams of American Army engineers were organized. Geneva-type control posts were set up. There was a "dry run" to test the 1958 Geneva system.

The on-site inspection teams found their geophones, for recording aftershocks, picked up no signals at all after the first few minutes. They could not be counted on to help, as had been expected.

Aerial and ground inspection, photographic and visual, did disclose rock slides, cracks in the earth, broken roads, and withered trees. But these above-ground signs were possible only because the tunnels for the Hardtack shots had been dug so close to the surface, scientists agreed. All these effects could have been avoided by placing the explosions deeper.

Seismologists reported the grimmest findings. At Geneva it had been assumed that most explosions would register differently from earthquakes. But this did not turn out to be the case. Seismographic readings for the explosions were not always distinguishable from readings produced by earthquakes.

Another disturbing discovery was made. The amplitude of the signals from the underground nuclear explosions was much smaller than calculated at Geneva a few months earlier. The nineteen-kiloton shot code-named Blanca came out looking like any one of 2,000-odd earthquakes that occur each year. Smaller shots were lost in the normal background noise and small earthquakes that all seismographs pick up. They did not stand out nicely, ripe for inspection, as the Geneva experts had expected. Thus the previous estimate that there would be only twenty to 100 suspicious shocks a year to be investigated was shown to be inaccurate.

The Americans published some of these depressing findings early in 1959 and tried to get the Russians to discuss them. The Reds ducked until last November. By that time the Americans had developed other theories showing new difficulties: Underground shots could be camouflaged by setting them off in the middle of huge underground cavities.

Theoretically, a 300-kiloton shot, fifteen times the size of the Hiroshima bomb, could be made to look like one kiloton—or one of 30,000 small earthquakes. And a 100-kiloton blast could be made to register on seismographs like background noise, or a one-third kiloton shot.

The Russians came to last year's experts' conference ready to attack all the American findings. The amplitudes American scientists had attached to the Hardtack explosions were too low, the Soviet experts said. Too many low readings from individual seismographs had been used in calculating averages. Merely drop the low readings, and the amplitudes would go up, they said. Juggle the figures, in other words, to prove whatever you wish.

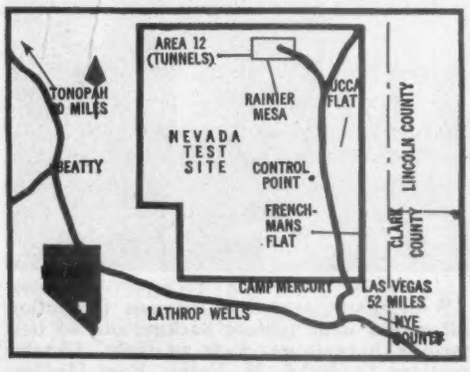
The Soviet scientists' pretext was that the low-amplitude readings included in American averages were produced by inferior seismic stations. The Russians of course had no first-hand knowledge about the American stations. The California stations they questioned were, in fact, among the best in the world.

This Soviet performance was without precedent. Seismologists all over the world use the same method of averaging out readings to measure earthquake magnitudes and differences are unheard of. If the Soviet scientists were ready to argue over the basic instrument readings in this conference, of course, there was every reason to believe they would wrangle much longer and harder in an actual International Control Commission, once it were set up. Arguments could go on for weeks while telltale evidence of a sneak shot could be hidden.

Later the Soviet delegation produced its draft of criteria which it proposed for dispatching on-site inspection teams. It went to great lengths to restrict the inspectors' movements.

The Russians had been given some 250 American seismographs from the Hardtack series, proving that

BASIC INFORMATION CONCERNING UNDERGROUND EVENTS AT NEVADA TEST SITE



Code Name of Event	Coordinates of Detonation Site	Elevation of Detonation Site	Burden over Device	Hour and Date	Yield in Kilotons
		ft. above MSL	ft.		
Rainier	890,571N 635,003E	6615	900 vert. 900 min.	10:00 9/19/57	1.70
Tamalpais	890,402N 635,788E	6611	410 vert. 330 min.	14:00 10/8/58	0.057
Neptune	889,877N 636,015E	6172	110 vert. 99 min.	10/14/58	0.103
Logan	886,350N 635,615E	6135	932 vert. 830 min.	22:00 10/15/58	4.50
Evans	890,232N 634,540E	6620	855 vert. 855 min.	16:00 10/28/58	0.050
Blanca	886,988N 635,353E	6135	988 vert. 835 min.	07:00 10/30/58	*23.00

*Later revised to 19.00 kt.

CONTINUED

nuclear explosions frequently produced seismograph tracings similar to those of earthquakes. Still, the Soviet criteria provided that one, or at the outside two, earthquake-type signals registered by the control system should be sufficient to label an event as an earthquake, and thus to disqualify it for on-site inspection.

This criterion would have exempted America's Hardtack nuclear shots from inspection, for even Russian seismographs registered the first motion of Blanca as an "earthquake."

Photo courtesy Bureau of Reclamation, Dept. of Interior

Some secrets of "big-hole" explosions are revealed in little holes like this, in which geophysicist adjusts a seismometer. Multitude of delicate instruments can be turned loose on underground tests. Some won't help a bit.

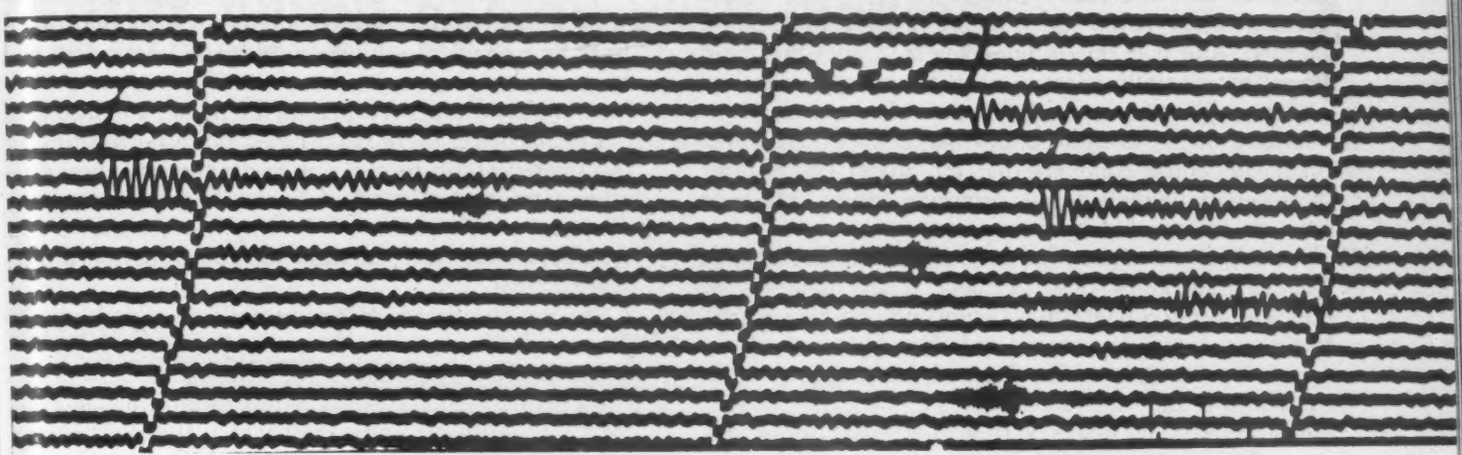


Photo courtesy US Coast & Geodetic Survey

Seismographic recording, made in 1948 by US Coast & Geodetic Survey, illustrates similarity of readings from earthquakes and nuclear explosions. On left segment is a reading from a distant quake. At right center are two recordings from surface nuclear tests at Pacific site. The reading beneath them and to the right is a local quake.

The Russians' criteria also stipulated that only two or three men could make up the inspection team investigating a suspicious event. This number would hardly be sufficient to operate the drilling rig.

Soviet haggling throughout the conference on points of simple seismology, accepted throughout the world, left most American scientists with the definite impression that an International Control Commission could be completely frustrated from carrying out its policing function, in much the same way that the international inspection system had been frustrated after the 1950-53 Korean War.

Still, President Eisenhower agreed with Prime Minister Macmillan at Camp David to press on with establishment of the International Control Commission, apparently on the theory that evidence of Soviet bad faith was not yet clear-cut enough.

The most dramatic confrontation of the 1959 experts' conference followed the American presentation of the "big-hole" theory for camouflaging underground shots. Dr. Bethe and Dr. A. L. Latter of the RAND Corporation presented US findings, intended to warn that detecting violators of a treaty could be an extremely difficult job.

The Russians listened to the American presentation and then announced they would "demolish" the theory. They wrote out their formulas on the blackboard, developing them as they wrote, and proved to their obvious satisfaction that explosions in big underground cavities would produce as big a signal as any others.

Then, some days later, Dr. Latter and Dr. Bethe used the Russians' own equations and proved them wrong. At first only a few of the Soviet scientists understood. One of these was Dr. Fedorov, the Soviet chairman. Eyewitnesses say he turned gray, then white, and appeared about to faint. He was speechless for several minutes.

The Americans went over the theory in detail many times, even conducted what they called a "freshman course" to convince all the Soviet scientists. But the Russians could never bring themselves unequivocally to accept the American big-hole theory in public. The political consequences were apparently too great to accept.

Their disclosure that they had tested the American theory with small-scale experiments could be only the visible part of the iceberg, of course. The test they made was in much too small a cavity to muffle the size of explosion set off. What other experiments may have been conducted by now the West cannot know.

The Russians did discuss their seismic records of large, unhidden subterranean shots, some as powerful as 3.5 kilotons. They claimed to have used nonnuclear explosives. There is no way of knowing, either, whether these tests were really with nonnuclear explosives, or whether the Russians were still holding back vital parts of the evidence they collected.

There was considerable suspicion, in fact, at both the 1958 and 1959 conferences, that the Russians were playing possum, disclosing only a minimum of the

(Continued on following page)

information at their disposal. No proof of the possum theory is possible, and there are those who do not believe it.

British scientists later presented experimental proof that the Americans' big-hole theory was valid. The United States, for some reason, had not tested out the theory itself before the conference; American experiments were later conducted in Louisiana salt mines. They showed that the muffling effect could reduce a seismic signal to one-hundredth of its normal size.

United States scientists believe their Soviet opposite numbers now are really convinced that huge underground shots could be concealed by the big-hole method. And it is this judgment which puts President Eisenhower's willingness to continue a moratorium on undetectable tests in its grimmest perspective.

Sitting in the Kremlin policy-maker's seat, for a moment, one could conclude that the Soviet Union must of necessity launch a test program, either secret or open, in its own national interests.

American scientists have proved conclusively at Geneva they know how to cheat. They have shown they know the Soviet Union could not be sure of detecting an American sneak series of subterranean shots. Soviet intelligence in this country has an easy time, compared to American intelligence in the Soviet Union; but Moscow could never be sure the United States was not secretly testing.

The only logical course for the Kremlin then would be to resume its own testing in order to prevent American nuclear-weapons development from extending its lead.

Similar reasoning applies on our own side. Because this country has in effect "taught" the Russians how to test secretly, Washington cannot afford to continue its voluntary moratorium unless it wants to lose its weapons lead. Defense officials calculated early this year that the United States must resume testing by late summer or fall to protect its advantage, unless some new breakthrough in the detection field can provide assurances the Soviet Union really is not testing. Late in March, however, President Eisenhower agreed with Prime Minister Macmillan that the West would continue its voluntary ban until next year if the Kremlin joined in a research program to improve detection.

Why the huge risks in the test issue are not brought clearly and forcefully to public attention in this country can only be speculated upon. For one thing, the Administration has never been able to bring itself to admit it blundered in seeking a comprehensive nuclear-weapons test ban before it knew enough about the effectiveness of a control system.

Hiding the mistake was relatively easy. Most people want to believe that the nuclear-arms race can be stopped. And the subject is so complicated that the dangers surrounding it cannot be quickly grasped by the inexperienced in any case.

While the Administration has been covering up, it has been edging slowly away from the comprehensive test ban. The hope of some officials, at least, appears to be that the Eisenhower Administration can tiptoe away from the whole issue without the world ever finding out about the frightening risks taken in the past.

The President has succeeded in persuading the Russians to concede there are some types of underground tests that would be undetectable. His latest offer still hinges a comprehensive ban, even for a short period, on more honest inspection than the Soviet Union wants.

Furthermore, there will always be opportunities for the United States to pull out and resume testing, even after a treaty is signed, if Soviet bad faith becomes obvious enough, or if it can be conclusively shown that science is not now capable of detecting all underground tests.

Making the break, of course, will be a problem for the next President.

But the grim danger in all this is that the Soviet Union is now getting what it has sought; a one-sided ban, without inspection, under which the West cannot know if the Kremlin is improving its nuclear-weapons position. All the West can know for sure is that its own nuclear-weapons development is being effectively inhibited, if not stopped completely.

At this stage of the game, the Administration may well feel it is "in too deep" to make a clean breast of matters and resume testing.

Such a move would completely destroy the so-called *detente* which President Eisenhower and Soviet Premier Khrushchev agreed on at Camp David last September. There would be important repercussions in domestic politics.

Undoubtedly most of the world would condemn the United States if it resumed testing. A special session of the United Nations General Assembly might well be called. If it were, the British have reportedly found in an unofficial poll, the United States would get no more than ten out of eighty-two members to back her.

World opposition might have been tempered, if not avoided, of course, if the Administration had made a determined effort to explain the hopelessness of inspecting a test ban with presently known techniques. Since the West cannot know whether the Soviet Union is proceeding or not with its nuclear-weapons development, the safe course would be to resume tests underground to preserve our presumed lead.

The test moratorium, after all, is a key factor in the missile lag. The Soviet Union already has superior thrust for its rockets, so it can afford to lag somewhat with its weapons technology; its missile thrust is sufficient to support its huge, unsophisticated warheads.

With less thrust, American missiles can carry only smaller warheads, unless our scientists can develop more bang per pound. They can't do that without testing.—END

The author, Earl Voss, is diplomatic correspondent for the Washington Star *in the nation's capital. He has covered foreign affairs for that newspaper since 1951. Mr. Voss has contributed frequently to* AIR FORCE/SPACE DIGEST. *His last article, "What Are the Prospects for a Nuclear Test Ban," appeared in the December '58 issue.*

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A RED AIRPOWER FEATURE

YAK-42 BACKFIN . . .

SOVIET High-Performance FIGHTER-BOMBER

RUSSIA appears to be hiding one of her hottest aircraft under a bushel basket.

It is the YAK-42 fighter-bomber, code-named Backfin by NATO.

The YAK-42, known to be a high-performance airplane, poses something of a mystery.

Few YAK-42s have been seen by Western observers although the plane has been flown since 1956. Little data has been circulated. We do not know how the Soviets themselves rate Backfin in terms of weapons priority or strategic importance. Nor do we know whether it is in series production at this point.

The Russians could be awaiting development of an improved version before putting the airplane into full production. Perhaps the current model has serious bugs. The very real possibility also exists that the Red Air Force, with a nuclear-missile "new look" instituted in its defense planning, isn't pushing Backfin's development too hard.

Or, on the other hand, the Russians simply may not be interested in talking about this potentially deadly aircraft.

Here is what we do know about Backfin. These facts and figures seem to indicate that the plane is in a class with the best fighter-bomber types we have produced.

The YAK-42 is believed to have a range of 1,500 miles, a ceiling just over 50,000 feet, and a top flight speed of about 1,000 mph with afterburner.

It is another product of the USSR's most prolific aircraft designer, Alexander S. Yakovlev, whose many designs of transports, sports planes, training aircraft, helicopters, and interceptors have brought him no fewer than five Orders of Lenin and six Stalin Prizes. Work on the YAK-42 as well as the earlier YAK-25 Flashlight series of all-weather interceptors was carried on at OKB-115, one of the many experimental design bureaus in Moscow.

Backfin is 101.7 feet long, with a span of 80.4 feet. The deep fuselage suggests two jet engines, one mounted above the other. The air intakes are located behind the cockpit, on either side, atop the fuselage.

The relatively large cockpit can take two crew members easily and may have room for three. Red Air Force practice is to use a larger crew and fewer electronic and hydraulic aids than is common practice in the West. The flat radome under the nose is thought to be for target-location and all-weather bombing operations.

The inner one-third of Backfin's wing is swept back sixty degrees, and the outer portion forty-six degrees. The wing has a slight sickle or crescent shape. There are the usual flow fences found on so many Soviet aircraft. We may assume that large flaps are used to increase lift during takeoff and landing. In addition, during takeoff the YAK-42 may employ rocket assist. Permanent booster rocket mounts are housed in the fuselage and are used for short takeoffs or to get off with extra payload or fuel.

The engines are advanced versions of the M-209 (military version of the AM-3M), with thrust ratings just over 20,000 lb. Each engine weighs about 5,500 lb. These powerplants were developed early in the 1950s. The first models delivered no more than 11,000 lb. of thrust. Since then the Russians have improved the

Characteristics and Performance—YAK-42 Backfin

DIMENSIONS

Length	101.7 ft.
Span	80.4 ft.
Height	26.5 ft.
Wing area	1,016.8 sq. ft.
Aspect ratio	6.3

WEIGHTS

Empty Weight	48,400 lb.
Fuel	28,600 lb.
Crew (3)	660 lb.
Payload	11,000 lb.
Useful load	40,260 lb.
Max. takeoff wt.	88,660 lb.
Landing wt. (max.)	55,000 lb.
Wing loading	86.7 lb./sq. ft.
Thrust loading	2.2 lb./lb. thrust
Power loading	38.5 lb./sq. ft.
Useful load as percent of flight weight	45.4%

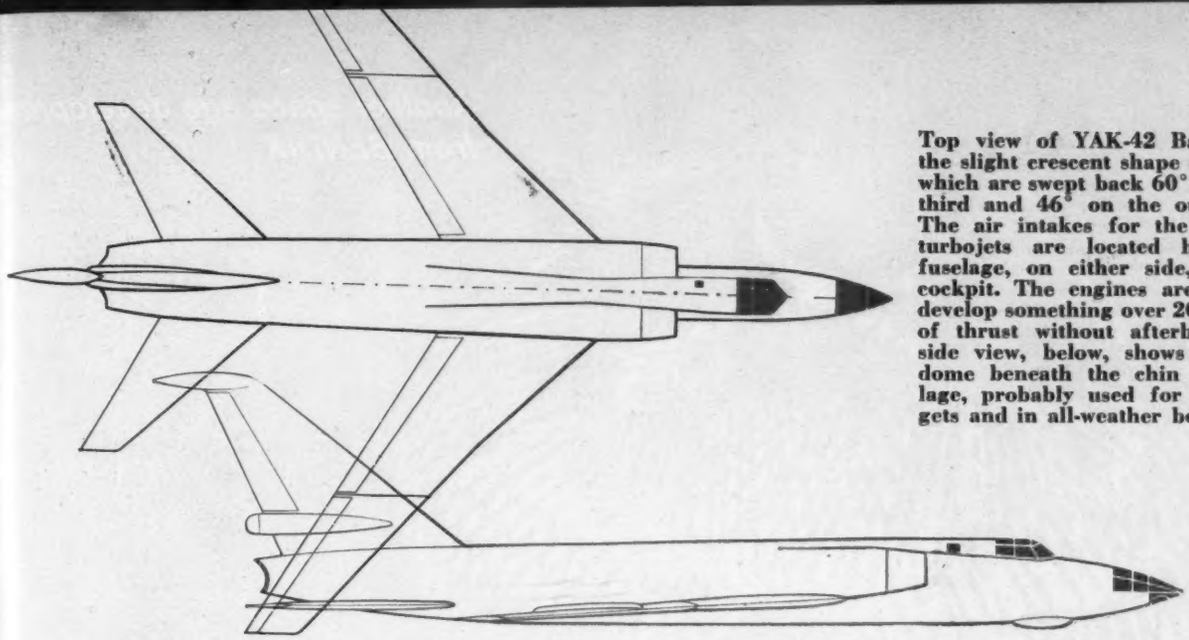
POWERPLANTS

Two M-209s @ 20,240 lb. each without afterburner
26,400 lb. each with afterburner
40,480 lb. total without afterburner
52,800 lb. total with afterburner

PERFORMANCE

Top speed @ 40,000 ft.	975 mph
@ 50,000 ft.	1,000 mph
@ sea level	838 mph
Landing speed	133 mph
Climb speed @ sea level	410 fps
Absolute ceiling	50,500 ft.
Range	1,500 miles
Endurance (nonafterburner)	2.5 hours
Takeoff distance over 50-ft. obstacle	5,900 ft. with rocket assist
Landing distance over 50-ft. obstacle	5,250 ft.

Note: All data are with afterburner, except endurance and range.



Top view of YAK-42 Backfin shows the slight crescent shape of the wings, which are swept back 60° on the inner third and 46° on the outer portion. The air intakes for the twin M-209 turbojets are located high on the fuselage, on either side, behind the cockpit. The engines are believed to develop something over 20,000 pounds of thrust without afterburning. The side view, below, shows the flat radome beneath the chin of the fuselage, probably used for locating targets and in all-weather bombing runs.

powerplant considerably. Many features of the engine have been redesigned, but the basic outline and most of the external parts have been retained. It is thought to remain a straightforward turbojet, single spool, without adjustable stator vanes such as found in our General Electric J79, which is used in the Lockheed F-104 Starfire.

With afterburner, the thrust of the advanced M-209 engine reaches a total of 26,400 lb. This means the afterburner coefficient is 1.3, about the same as current jet engines in the West.

Without afterburner, fuel consumption is 0.85 lb./lb. of thrust/hr., which is a little high by our standards. The engine is not thought to be a good performer at very high altitudes, *i.e.*, above 50,000 feet.

Little is known of the armament on the YAK-42. There is an automatic gun position in the root of the horizontal tail section. The tail itself terminates in a tear-shaped structure that probably houses radar equipment for aiming the guns. The YAK-42 in a tactical configuration can probably carry wing-mounted air-to-ground rockets. The large bomb bay is in the center of the fuselage.

The range of the aircraft—about 1,500 miles—is short by US standards but would be sufficient for operations in Europe. From airports in satellite countries, and in some instances, even from airports in the Soviet Union proper, the YAK-42 could reach prime NATO targets. In-flight refueling would of course increase the plane's range considerably. Under such circumstances it could be based deep inside Russia and yet could reach important targets.

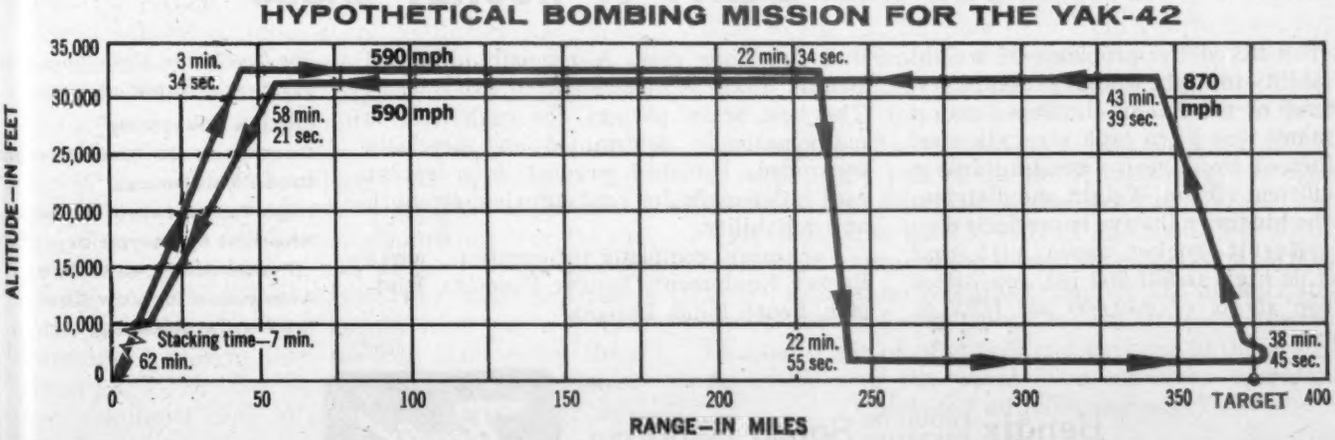
The accompanying diagram shows a hypothetical, short-range mission that the YAK-42 might fly. It includes a low-altitude approach to target on full afterburner at supersonic speed.

The takeoff takes place with auxiliary rockets and a fuel load of 28,600 lb. Some 200 seconds after takeoff, the aircraft is at 33,000 feet. It continues to fly at this altitude without afterburner until it is about 230 miles from takeoff, then dives to near ground level to get under radar at the intended target. Again, the flight is continued at supersonic speed, with afterburner, until the target is reached some thirty-eight to thirty-nine minutes after takeoff.

After the bomb is dropped, the YAK-42 climbs back to 33,000 feet, with afterburner, and heads for home. Now some 16,000 lb. lighter than at takeoff, it cruises at about 590 mph without afterburner. The total mission takes sixty-two minutes.

Perhaps the only free world interceptor aircraft that could cope with the YAK-42 would be the F-104 or the British Lightning P. 1. Significantly, Germany is to build some two hundred F-104s under license. This would seemingly meet the threat posed by Soviet aircraft of the YAK-42 type.—END

Diagram shows the profile of a hypothetical, short-range mission the YAK-42 might fly. After a fast climb to altitude, Backfin flies to within 150 miles of its target, then dives to near ground level to elude radar. After a high-speed bomb run on its target, the YAK-42, 16,000 lb. lighter, climbs to 33,000 feet and arrives home about an hour after takeoff.



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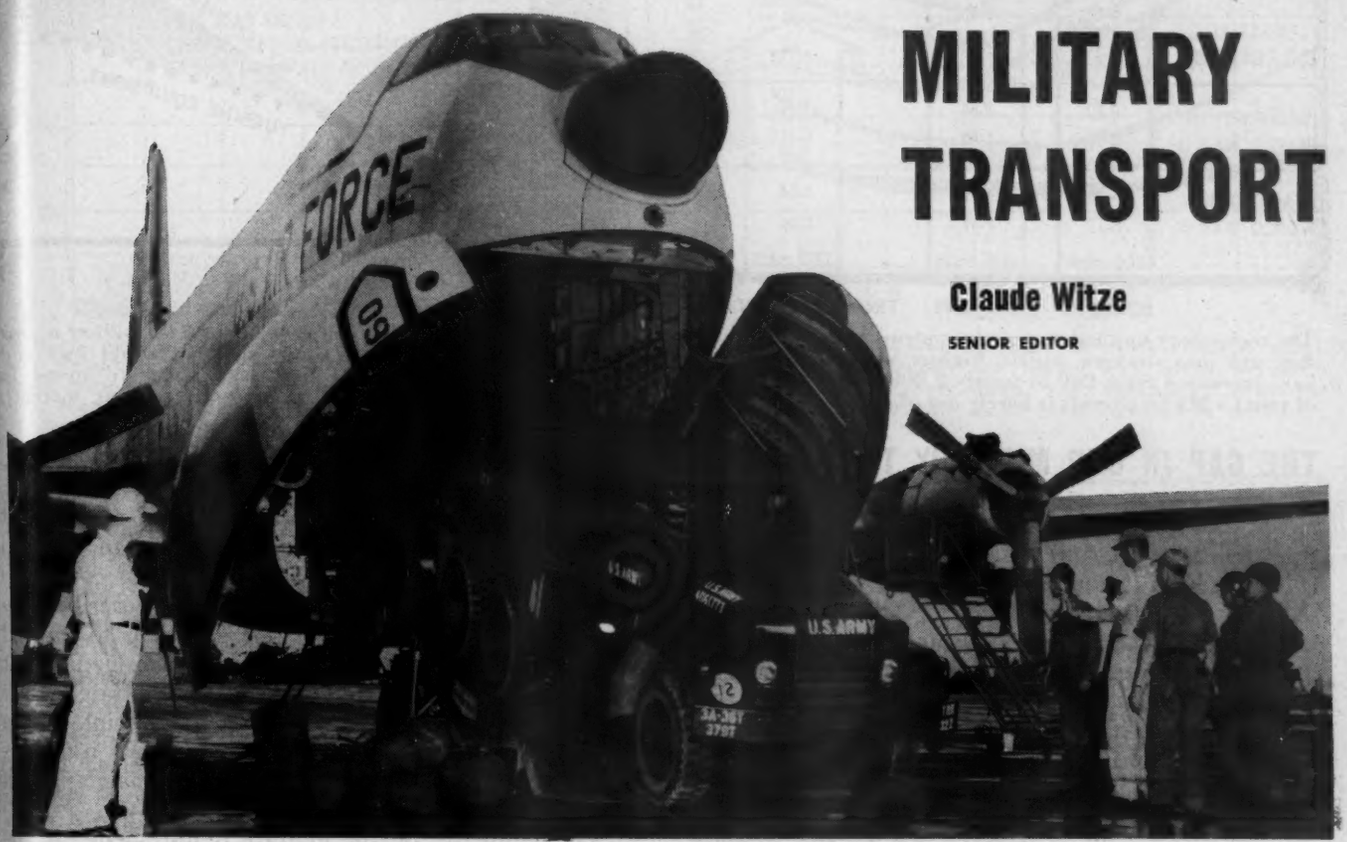
In Operation Big Slam/Puerto Pine, the Military Air Transport Service operated the biggest peacetime airlift in history. The operation proved that MATS has the organization, the determination, and the trained personnel to do its job. But, more than this, Big Slam provided grim evidence of . . .

THE GAP IN OUR MILITARY TRANSPORT

Claude Witze
SENIOR EDITOR



Army truck rolls out of MATS C-124 in Puerto Rico. The aircraft will take on a different load, go in two hours.

FROM the traffic pattern at Roosevelt Roads Naval Air Station, Puerto Rico, one day in mid-March, the field below and ahead looked surprisingly quiet. Navy patrol planes were parked on the ramp. Some amphibians were standing by for the search and rescue mission. There was a short line of single-engine aircraft for training flights. Visible was a single Douglas C-124 transport wearing the insignia of USAF and the Military Air Transport Service, its yawning jaws open and a gas truck pulled up next to the wing. There was a MATS Douglas C-118 waiting for the takeoff.

About a hundred miles away, at Ramey Air Force Base on the opposite corner of the island, there was a similar scene. It was hard to believe that these two fields were the receiving points for the biggest peacetime airlift in history—Big Slam/Puerto Pine—and were in the midst of handling 41,596 passengers and moving 21,794 tons of cargo. At the peak of the operation there was a MATS aircraft arriving over Puerto Rico every seven and a half minutes, every fifteen minutes at each offload base. They were departing at the same speed, which means there was a MATS operation in Puerto Rico for Big Slam every three minutes and forty-five seconds. Average turn-around time was down close to two hours—twenty-four minutes was the record set by the C-118—and the schedule reliability was 93.2 percent.

The exercise, involving more than 20,000 Army, National Guard, and Army Reserve troops, and nearly 11,000 tons of equipment, lasted for two weeks. MATS picked up passengers and cargo at fourteen points in the United States, offloaded and onloaded at the two fields in Puerto Rico, and returned its loads to their home bases. The operation involved 24,640 flying hours and 2,526 sorties. There were no accidents, continuing the perfect safety record set by MATS in 1959.

At times as many as a hundred MATS transports were in the air, en route to or from Puerto Rico, but even this did not tell the whole story. Big Slam, to MATS, was more than an exercise with the Army. It was a test of the entire MATS organization to meet the demands of a wartime surge. Big Slam was global in scope. Only half of the airlift capability was used for the Puerto Pine part of the exercise.

In addition to the 225 aircraft and the 24,640 flying hours that went into the Puerto Rico operation, MATS at the same time was using another 222 aircraft and about 23,000 flying hours to maintain its regular channel traffic of personnel and supplies to the armed forces all over the world. The combined operation

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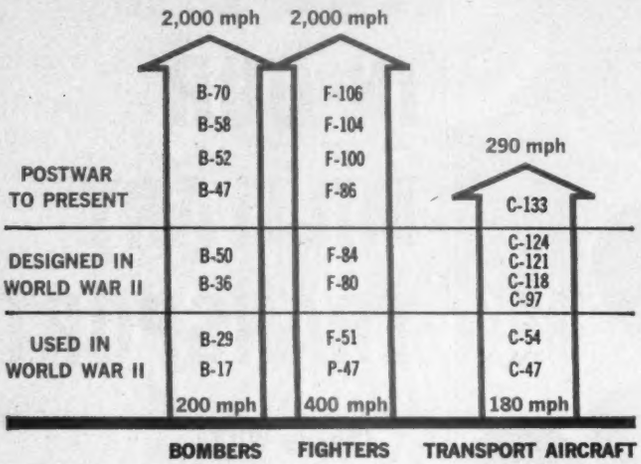
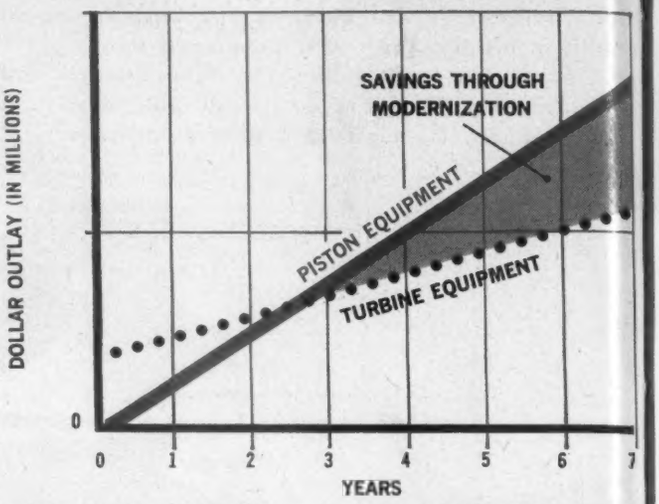
USAF AIRCRAFT MODIFICATION PROGRAM



The technology applied to weapon systems has far surpassed that put into strategic airlift. Fighter and bomber speeds have increased from 200 to nearly 2,000 mph. But the best of today's MATS aircraft is barely out of World War II class.

ECONOMY OF MODERNIZATION



Modernization of MATS can save about $40 million a year in operating costs. Chart shows how we could buy *and* operate a modern turbine fleet with what we spend in less than three years just to *operate* present aircraft.

THE GAP IN OUR MILITARY TRANSPORT

meant that MATS increased its normal utilization rate from five to seven and a half hours a day. Crews involved in both operations worked twelve hours a day, seven days a week. In short, MATS did a month's work in two weeks. The total air miles rolled up in the two weeks was about five million.

The story of the MATS accomplishment during these two weeks already is under scrutiny in Congress, where some kind of action is awaited to overcome the obvious gap in military transport. One of the failings of Big Slam is that none of the statistics and none of the headlines coming out of the exercise makes it clear that the gap exists. What Big Slam proved in the obvious way is that MATS has the organization, the trained personnel, and the determination to do the job. It did not make clear the inadequacies of MATS equipment.

Modernization of MATS now is critical. There are 483 airplanes allocated to the strategic airlift fleet. Here is how they are divided:

- There are 107 Douglas C-118s. This is a military cargo version of the airline DC-6A.
- There are fifty-six Lockheed C-121s, military counterpart of the Constellation.
- Workhorse of the strategic force is the Douglas C-124 Globemaster. There are 291 of them in MATS. There is no commercial version. The airplane first flew in 1948. It is obsolescent, slow, and requires midocean island bases for refueling on most intercontinental missions.
- Newest airplane in the MATS stable is the Douglas C-133 Cargomaster, a turboprop giant that is not designed for passenger hauling. MATS has twenty-nine in inventory, will have fifty when deliveries are complete.

With the exception of the C-133, the entire fleet is out of date in speed, range, and over-all capability. It is increasingly expensive and difficult to maintain.

Outside of what it proved about the MATS capability to surge from a training pace to a limited-war operation, Big Slam's major contribution was that it focused attention on strategic airlift as an integral part of a weapon system. This system, of course, is the Strategic Army Corps (STRAC), described by the Army as a vital part of our deterrent to limited war. STRAC, says the Army, is a "fire brigade" that is constantly on the alert, just like the Strategic Air Command, and ready to move to any point in the world. The requirement, clearly, is for air transportation and is part of the "hard-core" demand put on MATS.

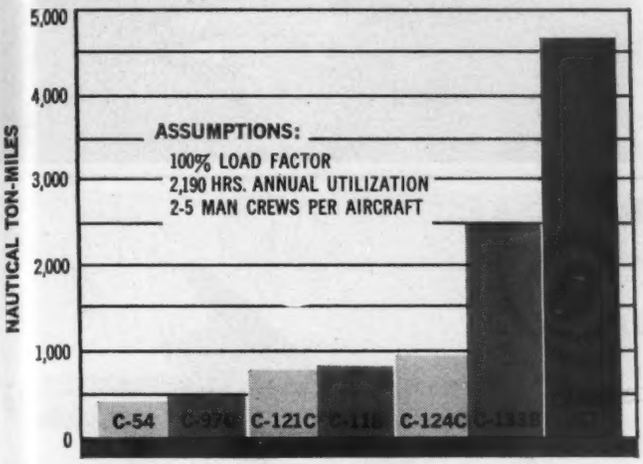
This emphasis, on the military requirement for airlift as a mode of transportation to replace surface transportation in the interests of national security, may be the most beneficial thing to come out of Big Slam. It comes at a time when some of the important men on Capitol Hill have become disenchanted, to one degree or another, with the campaign of the Air Transport Association to discredit MATS.

ATA has made an effort to show that MATS is a quasi-socialistic organization, definitely un-American, contributing little to the security effort that could not be done better by private enterprise. Not all airline members of ATA concur in either the conclusions or the techniques employed by their organization.

There has emerged from the discussions of Big Slam a realization that MATS, like the airlines themselves, is handicapped by lack of modern equipment. There is a new comprehension that the MATS system and all its component parts, which worked well in Big Slam, are a basic requirement for doing the wartime job. The MATS peacetime job trains and readies this system for what lies ahead. There is scarcely a single advance in the field of air transportation that was not pioneered by military transport requirements. More pioneering lies ahead, and again it will come from the military.

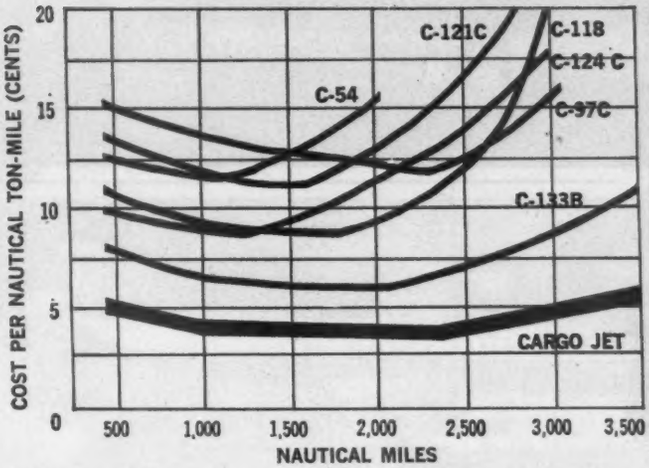
A good example of this is the Air Force decision that all personnel should be moved to and from overseas assignments by air. On a worldwide average this has

WORK CAPABILITY PER FLIGHT CREW MAN-HOUR (NAUTICAL TON-MILES)



With a modern airplane, a basic MATS crew of five men would generate about 23,000 nautical ton-miles per flight hour or 4,600 for each member of the crew. Ground crew economies would be equally substantial, studies show.

DIRECT OPERATING COST FOR SEVEN TRANSPORT AIRCRAFT



Douglas C-133B shows up here as most efficient plane in MATS fleet. Others are higher but could be more efficient for very short hauls. One company's proposed cargo jet would provide major improvement in economy.

CONTINUED

cut the time lost moving men from station to station by fourteen days. If you take the average man-hour saving and multiply it by the number of people moving in a year, the result, so far as the Air Force is concerned, is enough manpower to operate twenty-two Atlas missile squadrons.

The Air Force moves almost all of its personnel by air. The Army has just started a gradual progression toward a similar policy. USAF, and particularly MATS, has been trying to sell this concept at the Pentagon for a good many months.

There is a similar story to be told about air cargo. It was USAF that pioneered the air-logistics concept, moving supplies to foreign stations in a program that has saved about $7 billion for the taxpayers since 1953. The Air Force substituted air delivery for the overseas-stockpile concept for engines and other high-cost items. In the aerospace era that lies ahead, this program will become more than a simple business economy move, such as an efficiency expert might introduce. It will be a necessity in an age when quantities are limited and prices astronomical. Wider use of airlift by the Defense Department, in short, can reduce procurement and transportation costs and guarantee more efficient use of personnel. Full use of this asset by the armed forces has been promoted mainly by MATS.

There may be statistics, coming out of Big Slam, that will make this point more clearly. MATS, for example, contends it can move a full Army division to the Far East in 26.2 days by using *all* its existing equipment. If the MATS fleet were modernized, the job could be done in ten days, and in addition to the Army division the aircraft could move a four-wing Composite Air Strike Force from the Tactical Air Command.

Other studies show that a modern air transport can deliver a helicopter transmission from the eastern US to Japan for $8.59 less than it costs by surface transportation. In the area of missile logistics, the same study shows, it will cost $14,000 and nine days to move an ICBM across the continent. It can be airlifted in seven hours for $9,200. These facts have been presented to the Pentagon and Congress by MATS.

Here, for example, is a simple comparison from a current study of interest to the Army:

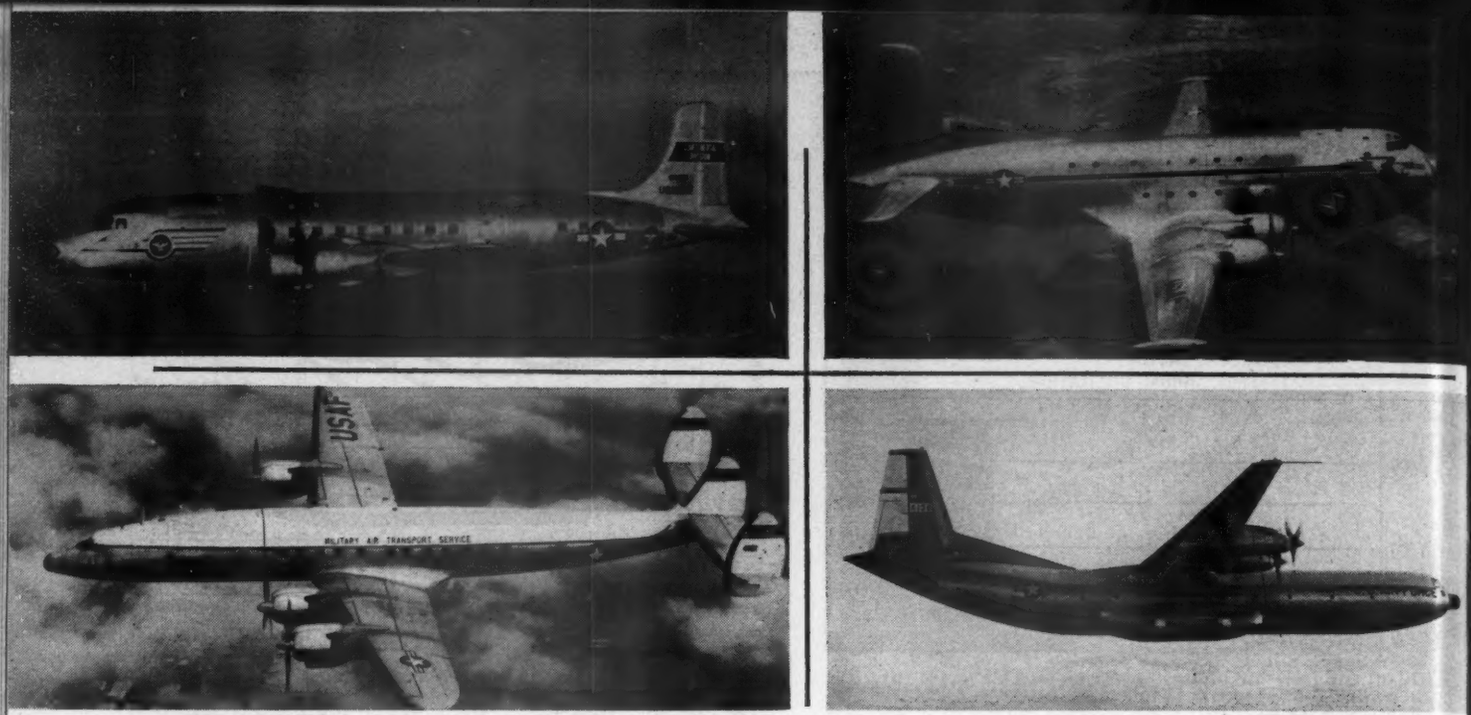
"... five typical cargo items were selected from the Army inventory list and cost comparisons computed for transporting from the US to overseas locations—airlift vs. surface. It was found that airlift could save from $15.34 for an office desk to $376.73 for a liquid oxygen tank." For a Congress that is highly concerned about budget problems, this is vital information. It is available from MATS.

There has been an effort to portray the MATS salesmanship effort as a somewhat sinister move to increase the demand for the purpose of justifying a larger MATS capability. This is not true. Maj. Gen. Raymond J. Reeves, MATS Vice Commander, has said experiences show "we must have a military force [in MATS] no smaller, but no larger, than the present one." He says the civil airlines, which collected $231.6 million from the Defense Department in fiscal 1959, will get the benefit of the increased requirement.

So far as MATS aircraft are concerned, the original program drafted at its Scott AFB, Ill., headquarters called for an eventual reduction in the size of the MATS fleet from 483 to 232 planes. The MATS proposal called for ninety-four swing-tail jets, adaptations of current airline passenger planes, fifty C-133s now being delivered, and 188 new "workhorse" aircraft.

USAF specifications for the new plane are being revised at this writing. The aircraft industry, however, has indicated what can be done and how a properly designed aircraft can save money. The savings in operating costs that will come with an efficient turbine-powered cargo plane will be an important factor in the considerations by Congress. It can be shown that the total operating costs for present piston-type aircraft will equal both the operating *and* procurement cost of a turbine fleet in less than three years. Modernization

(Continued on following page)



THE MATS FLEET OF TODAY . . . Upper left, the Douglas C-118, military version of the DC-6A; lower left, the Lockheed C-121, military Constellation; upper right, Douglas C-124 Globemaster; and lower right, the Douglas C-133 Cargomaster.

THE GAP IN OUR MILITARY TRANSPORT

CONTINUED

HOW THE CAPABILITY OF TODAY'S MATS AIRCRAFT COMPARES WITH THAT OF PROPOSED CARGO PLANES

Mission: The rapid overseas deployment of 5,567 troops and 2,920 tons of cargo

	Destination "X" 6,200 nautical miles		Destination "Y" 9,626 nautical miles	
FACTORS	PRESENT AIRCRAFT	PROPOSED AIRCRAFT	PRESENT AIRCRAFT	PROPOSED AIRCRAFT
Time	5.6 days	3.6 days	8.0 days	4.7 days
Number of trips	232	163	288	190
Number of aircraft required	290	103	360	119

of MATS will save about $40 million a year in operating costs and fill the transport gap for STRAC and other essential forces.

The workhorse airplane is visualized as a turbofan-powered cargo aircraft with a gross weight of about 315,000 pounds, a maximum payload of just short of forty tons, and a cruising speed of 575 mph. It would have global range, able to carry thirty tons of payload 4,000 miles, or twelve tons 5,500 miles. At a 2,500-mile range it would have a direct operating cost of four cents a ton-mile. As jet and fan engines of greater power become available, the ton-mile cost can be reduced to three and a half cents.

Applied to STRAC and an operation similar to Big Slam, the new plane would be able to transport seventy-eight percent of the vehicles and thirty-three percent of the total weight of a STRAC unit, providing high-speed lift to supplement the heavy-lift capability of the C-133s. With improved power, these percentages could be raised to ninety-four percent of the vehicles and seventy-three percent of the total weight of a STRAC unit. One aircraft of this type would have the lift capability of three C-124s or six C-118s.

For fiscal 1961, the original MATS program of funds for both procurement and development of a new optimum aircraft called for $250 million. As presented to Congress by the White House, the figure was cut to $50 million, barely enough to start development of a new cargo plane without purchase of any new interim equipment.

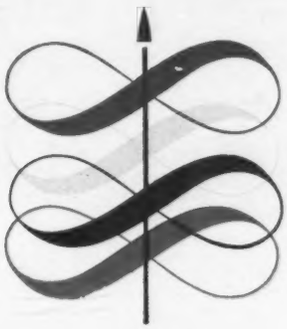
Almost at the same time that Congress received its report on Big Slam, Headquarters USAF was preparing a new budget proposal for MATS. It is expected to call for about $200 million.

Under consideration for procurement are fifty Lockheed C-130Bs, equipped with extra fuel tanks to increase their range. The company says deliveries can be started in less than a year on these turboprop aircraft, and the price would run a little more than $2 million each. For an interim high-speed transport the proposal will seek fifty cargo versions of the Boeing KC-135 tanker. This would not be the swing-tail cargo plane favored by MATS a year ago, but a modified tanker with beefed-up floors and a side door for loading. Money also would be provided, as it is in the President's budget, for development of the workhorse cargo plane.

There are strong indications that Congress, impressed by MATS efficiency and alarmed by the lack of modern equipment that would be essential in the limited-war situation for which STRAC was organized, will increase the funds. So far as the Air Transport Association campaign is concerned, there are equally strong indications that it has backfired. ATA witnesses have been sternly challenged before a House hearing, and at least one influential senator, A. S. Mike Monroney of Oklahoma, has expressed bitterness over the situation.

"I'm sick and tired of the airlines' inability to look beyond their nose," Senator Monroney told an Oklahoma City newspaper. A moment later: "I can't afford to wait. I will go all-out to equip MATS with a modern fleet."—END

THE SPACE AGE IN PERSPECTIVE



SPACE DIGEST

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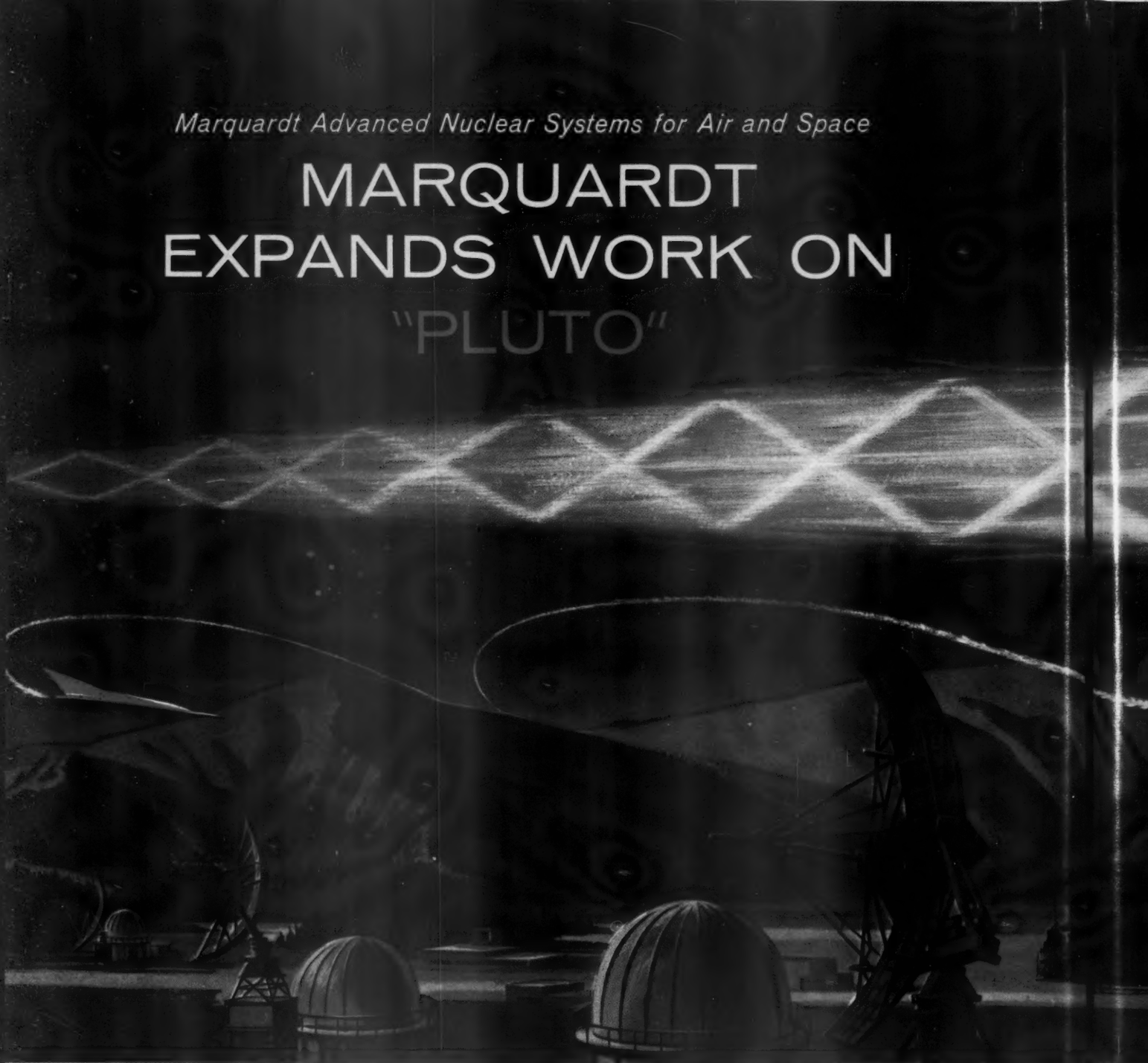
Marquardt Advanced Nuclear Systems for Air and Space

MARQUARDT EXPANDS WORK ON "PLUTO"



Broadened team effort with University of California's Lawrence Radiation Laboratory aims toward early feasibility demonstration of a nuclear ramjet reactor (Project PLUTO).

A supersonic, low-altitude missile capable of weaving, feinting and dodging unobserved by conventional radar while seeking out selected targets — this is to be the mission of the Air Force's proposed nuclear ramjet-powered vehicle of virtually infinite range.

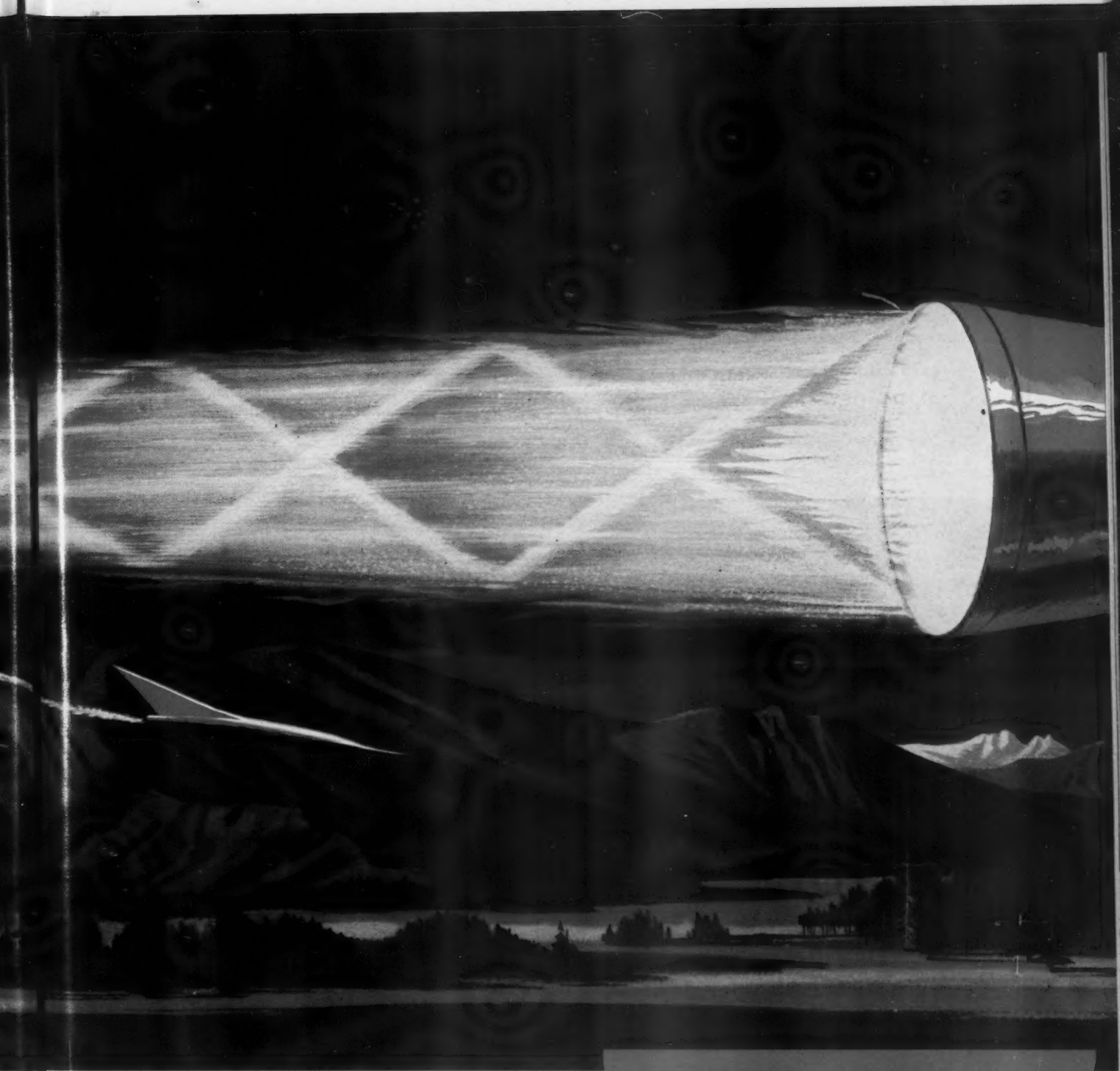
As an integral part of the team which is contributing to this country's all-out race for supremacy in weapons, Marquardt is working with the University of California's Lawrence Radiation Laboratory on the nuclear ramjet program, known as Project PLUTO.

Marquardt's basic PLUTO effort concerns preliminary design of the nuclear ramjet and development of airborne reactor controls and other components for severe temperature and radiation environments. The multi-million dollar program supports a multi-phase corporate effort headed by the Nuclear Systems Division.

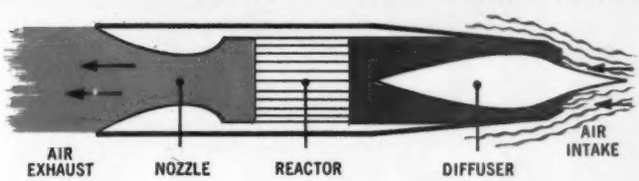
Other aspects of Marquardt's PLUTO effort include: support of LRL's feasibility tests on the non-flyable Tory IIA reactor; design and fabrication of significant portions of the reactor's control system, air ducts, flow instrumentation and remotely operated disconnects; fabrication and test of reactor core structural components; architect-engineering on the test air supply system; participation in a supporting program of environmental tests; and preliminary design of test facilities for full-scale power-plant development.

Highlights of the Corporation's other current nuclear programs include: exploration of both military and non-military applications for transportable reactors of advanced design, including their use for space power; development of the engine control system for the G-E nuclear turbojet; research studies of advanced space propulsion devices utilizing nuclear concepts; materials and processes work with molybdenum, other refractory metals and ceramics; and development of original nuclear instrumentation.

For a copy of Marquardt's new "Nuclear Systems" brochure, write to Mr. Aikman Armstrong, Chief Applications Engineer-Nuclear Systems, The Marquardt Corporation, Van Nuys, California.



THE NUCLEAR RAMJET



Nuclear Systems Division of The Marquardt Corporation is engaged in a continuing search for engineers and scientists capable of contributing advances in nucleonics state-of-the-art. Current expansion within this division creates challenging opportunities for: REACTOR PHYSICISTS • CERAMICISTS • NUCLEAR ENGINEERS • METALLURGISTS.

Qualified men are invited to contact: Mr. Floyd Hargiss, Manager, Professional Personnel, The Marquardt Corporation, 16555 Saticoy St., Van Nuys, Calif.

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FORECAST

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MARTIN
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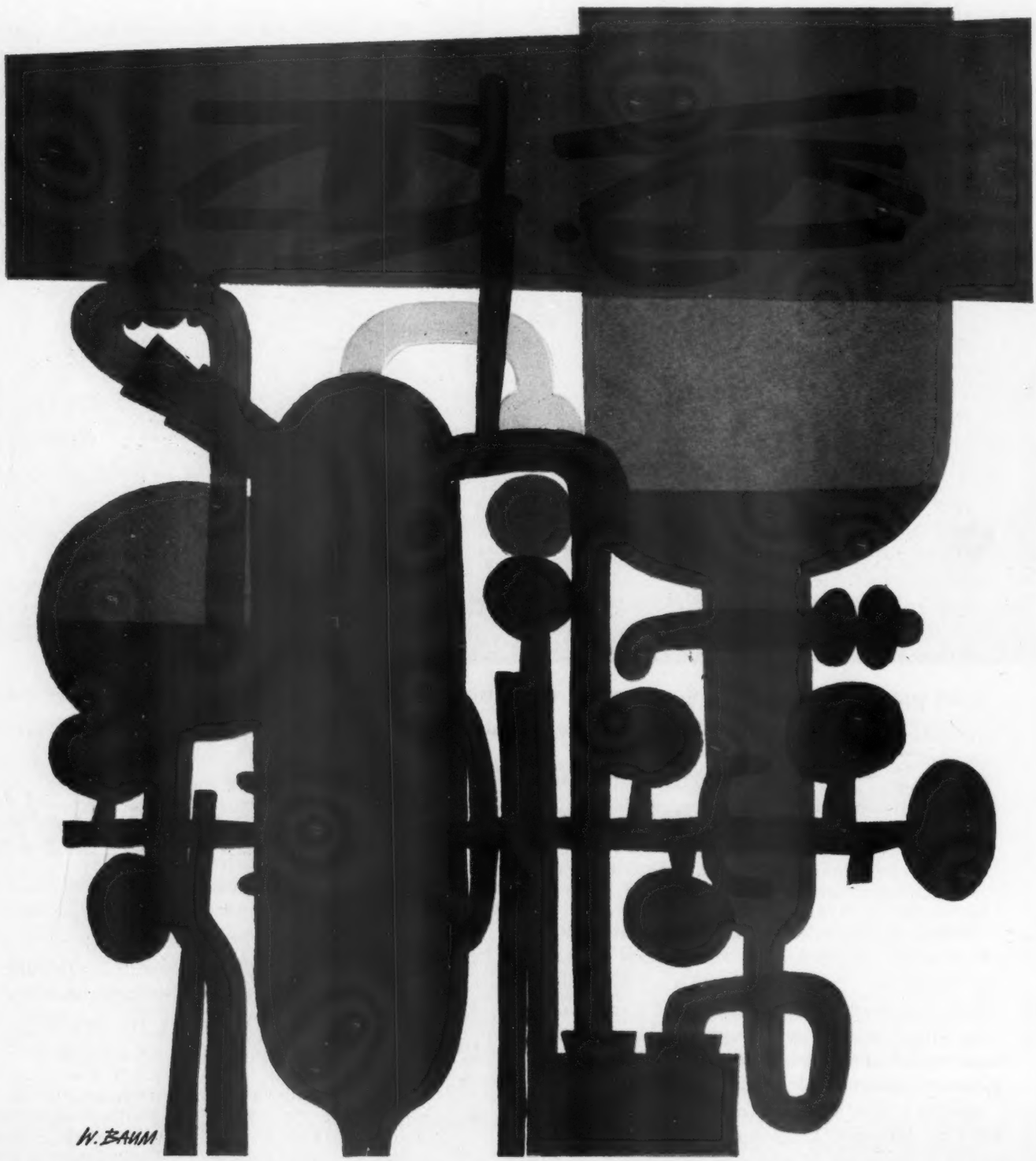


If there is intelligent life on other worlds, Project Ozma, using the great new tools of radio astronomy, may enable us to make contact with our distant neighbors in the universe . . .

TUNING IN ON OTHER WORLDS

JAMES B. EDSON

WE HAVE not yet found means for the direct observation of planets that circle other suns. There is, however, considerable indirect evidence that at least a few percent, and perhaps most, of the stars have planetary systems. If these resemble ours, we might reasonably expect that each would contain at least one planet sufficiently like earth to support life as we know it. It is conservatively estimated that one star in a thousand carries a planet hospitable to some form of life. Even if this estimate should prove a million times too big, there would still be a hundred billion such planets in the known universe. The conclusion that other earthlike planets circle other stars is as sure as any indirect deduction can ever be. . . .

Upon how many millions of worlds have other breeds of life faced the . . . crisis of sudden perceptiveness and exploding powers? Could it be, perhaps, that our future is their history, that our most pressing problems have answers in the records of countless ancient libraries through the universe? If so, how can we make contact with them?

The prospect is as exciting as it is improbable. Yet there is a way to attempt such contact, and men will begin this year to employ it. . . .

Here on earth, intellect developed first in an aggressive, social, and intensely curious breed. Among any creatures so endowed, science and technology seem almost certain to appear. Perhaps that is so elsewhere.

How long would such a culture survive? In the case of our earth, things may remain fairly comfortable for something like another five hundred million years. If we assume that an earthlike world around a sunlike star bears a technical culture for, on the average, one-tenth of the time the star continues to be sunlike, then perhaps something like one star in ten thousand has a planet with a technologic culture.

So, let us assume what seems reasonable—"they" are there.

But where? And what might these other civilizations be like? If our own experience is an indication, a civilization begins when hunting is supplanted by the cultivation of food products. It will achieve, in a few thousand years, a technology, a mastery of its environment, [useful] machines. . . .

The next step (in our case) is the development of machines that sense, transmit, and manipulate information. These machines communicate, calculate, regulate, eventually cogitate. A part of this trend is an increasing capacity of machines to make and repair other machines. If machines achieve the power to reproduce and manage themselves, one may imagine a world in which ma-

chines would no longer need the services of the race that developed them.

Perhaps we have here a main division of other civilized worlds—between those in which the functions of work and regulation have passed from animate to inanimate matter, and those in which life forms still participate in these functions.

Another factor must have long since divided civilized worlds into two classes. One class consists of the "lone worlds," from which astronautics is impractical because of deadly radiation or other dangers in the local space, or because a particular world moves alone around a lonely star. The other class may be the "astropolitan" worlds which, inhabited by space-faring breeds, are members of an interplanetary or an interstellar society.

"Astropolitan" cultures are most likely to be found where many stars swarm closely together, as they do by the hundreds of millions in the galactic center, and in the globular clusters of stars scattered about our galaxy. There, the average distance between stars must often be less than half a light-year, and the stars move among one another so that over the millennia one is perpetually exchanging old neighbors for new. . . .

If there are such astropolitan cultures as we here imagine, what commerce flows between the stars? . . . What goods are so rare and precious as to summon traders from a distant star? . . .

It is hard to name a material or product so rare that a culture capable of astronautics could not produce it on the home planet. But there remains one commodity . . . information.

So it could be that the worlds of an astropolitan community are linked by a wonderful commerce of communications. Perhaps the worlds of two passing suns barter science. . . .

In that case, many ships may move among the *planets* of any one star, and few, or almost none, between the stars.

What is our own place in this astropolitan picture? Our sun is far out from the center of the galaxy. Orbiting in a path about three-fifths of the way out to the galactic rim, our sun has never passed through the center, and never will. Nor is it near any of the globular clusters. Our part of the galaxy is . . . an "out-back."

Sparsely populated with stars, it seems to present little reward for contact by any distant interstellar center. Confronted by the innumerable suns of our galaxy, the most adventurous race of astronauts is not likely to visit us. . . .

Our rural situation is perhaps fortunate. In a cluster, the first cultures that evolve might spread to take the other pleasant worlds and thus forestall or dominate the development of "native" life forms. We have escaped such interference.

Yet we are not utterly alone. We do have quite a number of comfortably distant neighbor suns. With these neighbors, if they bear technologic culture, we may develop a highly profitable but not too hazardous contact. That remote but pivotally important possibility will . . . be explored by Dr. Otto Struve, Dr. Frank B. Drake, and others in Project Ozma at the National Radio Astronomy Observatory.

They will use large "radio telescopes" and new, sensitive receiving equipment to record radio energy coming from nearby stars. Most of this (perhaps all of it) will be natural cosmic noise. They will employ various means to search for signs of artificial signals, distinguishable from the noise. . . .

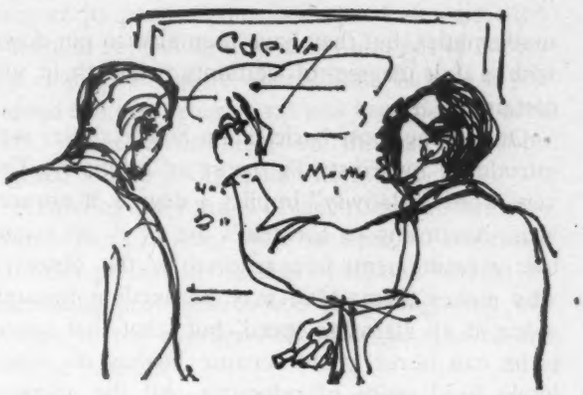
With equipment just now coming into existence, experts estimate that we could send and receive at a range of about 8.6 light-years—about twice the distance to the nearest star. With the 600-foot-diameter telescope now under construction, this range will increase to sixty light-years. The 1,000-foot "bowl" radio telescope planned by Cornell University for Puerto Rico would permit communication with planets around any of the ten thousand stars that lie within a radius of 100 light-years of us. . . .

Our listening for the voices of the "others" will, of course, begin with those few nearby stars which resemble our own sun, and thus seem most likely to have earthlike planets. Seven such stars within a radius of fifteen light-years from us have been identified. They are: Tau Ceti, Omicron-2 Eridani, Epsilon Eridani, Epsilon Indi, Alpha Centauri, 70 Ophiuchi and 61 Cygni. . . .

Our minds will thus seek, perhaps touch, the minds and culture of those "others" who are masters of their own realms as we are here. The sequel to such contact at once fascinates and defies the imagination.—END

Dr. Edson is Senior Civilian Missile Adviser to the Assistant Chief of Staff, Intelligence, US Army. He holds physics and astronomy degrees from the University of Kansas and California Institute of Technology and a Ph.D. from Johns Hopkins. The above is condensed, with permission, from the New York Times Magazine *of March 13.*

The thorny problem of scientist-to-layman communication is further complicated by the fact that nature as we now understand it cannot be fully "explained" even in the mathematical terms that have always been . . .



The LANGUAGE of SCIENCE

DAVID BERGAMINI

NEW truths exposed today in the explosive growth of modern science cannot wait centuries for appreciation. Their immediate practical impact is too great. At a time when laymen . . . must wrestle with science as never before, many of the ideas that are important are so new that scientists themselves do not yet appreciate them fully and cannot yet explain them with the . . . perspective . . . of centuries.

One of the principal reasons for this interpretive lag is that many of the most basic discoveries in science do not come into the world like ordinary ideas, fleshed in words and pictures, but as the gaunt skeletons of formulas. The germs out of which they grew may have been ordinary and commonsensical, but they have been rewrought by the mathematical processes to which they have been subjected.

Mathematics, the language of science, is not like other tongues. Its symbols are atoms of distilled logic, far more compact than words in some ways but uncolored by any of the associations, sights, and feelings that make words immediately meaningful. As a result, mathematics cannot be translated phrase for phrase or symbol by symbol like French or Sanskrit. Most of its content is no more interesting than a housewife's accounts—pure numbers and quantities. . . .

Perhaps everyone should learn mathematics, so that senators and administrators need not be constantly at the mercy of interpreters. But if everyone did learn to think in equations, would they then understand science and nature? Until fairly recently one might have been sure they would. . . .

Then suddenly, in the twentieth century, Bertrand Russell was calling mathematics "the subject in which we do not know what we are talking about, nor whether what we are saying is true." What had happened? After three centuries of certainty, had the mathematical language suddenly broken down? Not on the surface, anyway. Einstein's theory of relativity, the major scientific event that had intervened in 1905, was an earth-shaking triumph for mathematical abstractness in general, and in particular for one of mathematics' most obscure dialects: non-Euclidean geometry. Yet something *had* happened, not just to mathematics but seemingly to nature herself. Because of relativity and quantum mechanics, because of more acute experimental eyesight, because of introspection into systems of logic, scientists were beginning to suspect that nature did not speak in human accents—that she was what she was and that the most beautiful, workable mathematical expressions of her laws were merely expert translations from a lost original.

To many scientists this new uncertainty was profoundly disheartening. It demoted them from demigods to gamblers, and they didn't like it. But a few found it an exhilarating challenge. And today, after unqualified successes with nuclear weapons and electronic gadgetry, scientists generally enjoy their role as successful cardsharps and wouldn't go back to being academic formulators of divine law for anything. They are still wrestling with the limitations and ambiguities of

mathematics, but they have been able to pin down with a fair degree of certainty what their uncertainties are.

One of the most basic of the uncertainties was introduced by Einstein's theory of relativity. The very word "relativity" implies a degree of unsureness. According to Einstein's use of it, all scientific measurements are relative to the observer who makes them. Man may be hurtling through space at an alarming speed, but what that speed is he can never know because he has no absolutely fixed point of reference. All the galaxies seem to be in motion, but the motion he measures is partly his own and partly theirs: He cannot separate the two. From this one concrete implication of relativity, many scientists infer a broader relativity that makes any sort of absolute reality a figment of the human mind. Can man, a billion billion billion times bigger than an atom and a billion billion billion times smaller than a star, really discover "laws" governing atoms and stars? Or do his theories reflect only semantics and the workings of his own mind? Do relativity and quantum mechanics contain philosophic truths about the nature of the macro- and microcosmos,

$$e^2 = 1 - 4\left(1 - \frac{V_r^2}{V_e^2}\right)\left(\frac{V_r}{V_e}\cos\phi\right)^2$$

or do they consist simply of pragmatic rules that allow astrophysicists and atomic engineers to estimate the outcome of natural occurrences with a fair degree of accuracy?

Although philosophers of science are still wrestling with these questions, scientists themselves are mostly willing to admit that their most precise formulations are equivocal and that the only absolute truth is success—making ideas and formulas and machines that work. A good example of the ambiguity that scientists have learned to live with is the concept of curved space introduced into physics and cosmology by Einstein. According to the general theory of relativity, space as a whole is perhaps curved and space locally near any concentration of matter may certainly be considered slightly warped.

By "curved" or "warped" Einstein meant that all light rays and other seemingly straight lines would not obey the elementary postulates of Euclid's geometry. Instead they would behave like great circles on a sphere or the curves that represent the shortest routes between points on other kinds of surfaces—doubling back on themselves, failing to satisfy the usual definitions of parallelism, violating the triangulation laws of ordinary surveying. Whether or not space as a whole is curved is still an open cosmological question. But observation has shown that a straight ray of starlight does describe a gentle arc if it passes close to the concentrated mass of the sun. Depending on how the mathematical symbols of relativity are translated, this may mean either that space near the sun is curved or that starlight is subject to the tug of the sun's gravitation.

But what is gravitation? Is it a mysterious force like an electrical charge or is it a curve in space? The choice of which concept to apply and which name to call the mathematical symbols seems to be arbitrary and to have nothing to do with nature. Certainly the starlight itself doesn't care whether it is passing through a knothole in the texture of space or is being affected by something called gravity. . . .

But perhaps one concept will not prove more fruitful or simple than the other. In the physics of light, for instance, it is sometimes easier to consider light as continuous waves and sometimes

$$\lambda = \cos^{-1}\left[\frac{1}{e}\left[1 - \frac{a}{Re}\left(1 - e^2\right)\right]\right]$$

as tiny projectiles of energy, enormous in number but separate. It all depends on the part light is playing during the [specific] investigation. . . .

Until early in the nineteenth century, mathematics was based on sets of axioms and postulates that were considered self-evident. But then a succession of innovators began to ask why they were self-evident and to construct new experimental kinds of mathematics—like non-Euclidean geometry—based on axioms that were not self-evident and sometimes seemed to be patent nonsense. Playing with these mental toys, they found that they could construct wonderful edifices of equations on almost any assumptions at all. And though the assumptions might make no sense, the way the assumptions were manipulated did make sense. They found that they could generalize certain kinds of mathematics so that a single framework would hold and handle sensible propositions as one special case among whole sets of comparable nonsense propositions. More important, they found that the nonsense problems often turned out to make sense. An assumption that

seemed to be about geometry and seemed to be silly might turn out to be a key truth when interpreted in terms of electricity.

And so mathematicians like Russell became convinced that the symbols in equations need not have verbal meaning. Manipulating the symbols correctly is all that matters. . . .

Making sequences of symbols that are not significant but rigorously logical is far more difficult than ordinary reasoning, because the mathematician cannot call up familiar words or sights to guide him and give him "intuition." Choosing his dark path, he usually cheats a little and starts out with concrete ideas that he generalizes into pure abstraction only gradually. Then, having once abandoned all recourse to familiar notions from the world of reality, he has to move cautiously. Above all, he has to make his logic foolproof. In doing this, mathematicians have learned to be intensely introspective about their mental processes and wary about their use of words. . . .

By having the words and common sense weeded out of it, mathematics has grown far more general and pragmatically useful than it used to be. Theorems developed in the approved modern manner apply, at their best, not only to this universe but to all possible universes. On the other hand, the old hope that man will discover the final master formula explaining the whole of creation has either vanished altogether or faded into the distant future. This is partly because most of the equations hitherto fitted to nature have turned out to be only very exact approximations and partly because in 1931 a twenty-five-year-old Austrian, Kurt Goedel, published one of the most marvelous and revolutionary proofs in the history of mathematics. Goedel proved that all the possible theorems of mathematics can never be deduced from a finite number of assumptions. No matter how many assumptions have been made already, mathematicians can always make more and from them derive new truths—meaningless symbolic truths, of course, but unless the universe proves finite in both time and extent, there is no assurance that these truths cannot be given meaning some day and interpreted to shed new light on the cosmos.

The kind of ultimate barrier to total understanding implicit in Goedel's proof is reminiscent of one of the basic physical findings of quantum mechanics. This is Heisenberg's uncertainty principle, which says that a scientist cannot find out both where a subatomic particle is and where it is going without making it go somewhere else instead. The reason for Heisenberg's principle is simply that you can't "look" at something—measure its precise place and speed and direction—without subjecting it to a tiny amount of energy that changes its future whereabouts. It is as if you wanted to know where a rat was heading in a dark room. Shine a flashlight on the rat, and you frighten it into going somewhere else. . . .

Predicting the futures of electrons or other subatomic particles can only be done as insurance actuaries predict the futures of human beings: by calculating probabilities and estimating what will happen to the average—the average man or the average particle.

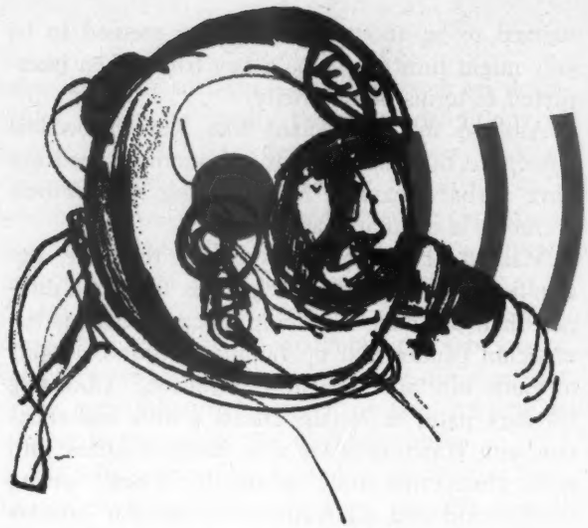
These two discoveries, Heisenberg's principle and Goedel's proof, are barriers that human beings can never hope to vault. Fortunately, they are neither of them very severe limitations to a scientist of spirit and imagination. Goedel's proof only says to the mathematician that he will never run out of lands to explore. . . . Heisenberg's principle only says to the physicist that he can never cut and dry an experiment beyond predicting what is probable. . . .

Both barriers leave the scientist with a residual world beyond certainty in which to exercise his metaphysical imagination. Beyond the barrier of Goedel's proof are very big numbers of particles. Beyond the barrier of the Heisenberg principle lie many of the exact mechanisms and processes of atoms—all the things which happen so fast that they can never be detected, according to the Heisenberg principle, without being found out as mere figments of the detection process itself. . . .

Obviously the interplay between the scientist and the layman should be important to both of them. The layman has to know about scientific advances to keep up with the world in which he finds himself. But the scientist has to return his findings periodically to the fount of common language and culture from which they sprang. He can get new ideas from the figures of everyday speech, and he can clarify old ideas by having to explain them concretely.—END

David Bergamini, assistant science editor at Life, *joined that publication in 1951 after a Rhodes Scholar tour at Oxford University. Born and raised in the Orient, he is working on a novel based on experience in a wartime internment camp in the Philippines. The above article has been condensed, with permission, from* The Reporter *Magazine of March 31, 1960.*

Computers, like all tools, save time and effort, but they remain an *indirect* use of intelligence. Needed for astronautics are lightweight systems that simplify data and give the human pilot the chance to feed into the mission his own unique capabilities



MAN has come a long way in the use of his intelligence. He has even learned to delegate some functions of his intelligence to machines, so-called electronic "brains" or computers.

It is timely to sound a warning. Machines only carry out functions for which they have been designed. Like all tools, they save time and effort, in this case mental effort. But always they are an *indirect* use of intelligence.

The tendency to trust entirely to computers, even to the point of making important decisions, hasn't the necessary philosophic justification. Apart from normal functional failures, which may result in wrong decisions, any operational application may present foreseen or unforeseen circumstances which should reverse the decision or lead to another alternative. Judgment based on the free exercise of *human* intelligence will take account of such circumstances.

The philosophical and historical background of the human spirit assures us of mental qualities which rise above the rigid framework of logic. Great advances in progress and resistance to the gravest dangers in human history depended not only on logic, but also intuition, imagination, good will, perspicacity, and a range of other qualities which have not and probably *cannot* be built into a machine.

Where all possible conditions can be anticipated, that is, where the circumstances are completely explored, it is quite likely that computers can give the right answer every time. But where unknown factors or exceptional conditions or unforeseen contingencies may be present, human judgment must take over. This is certainly the case with regard to space travel.

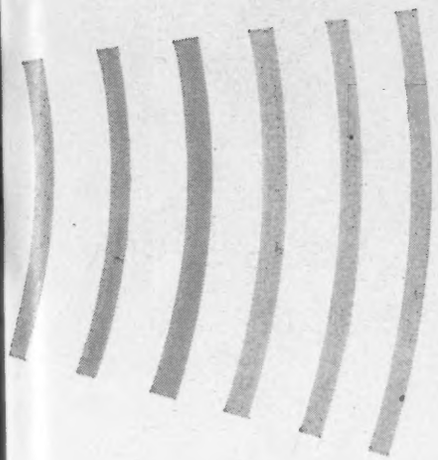
Present speculation on space travel places very considerable reliance on computers for predicting launching operations, orbital characteristics, and eventually, landing operations. Two reasons can be given to justify this reliance. First, that the space vehicle has been so far unmanned. Therefore, a machine must be used to guide it. The second is that the complexity of astronomical and gravitational calculations requires computers to provide for sufficient accuracy.

It is generally believed that before long the space vehicles will be manned. It is, therefore, high time to consider whether astronautical calculations cannot be reduced to a form which an intelligent person can use logically to get sufficiently accurate results so that the human operator, adding his own mental qualities, can attain the best practical results under all circumstances. This would not rule out navigational or mathematical aids. It is only a call to reduce the trust in machines and to trust the man instead.

The basic mathematical formulae for rocket acceleration and gravitational-ballistic orbits are relatively simple. The rocket formula gives the acceleration in terms of built-in thrust and weight factors. The accelerometer is a constant practical check. The basic formula for orbits is also quite simple, especially in polar coordinates. So is the formula determining the orbital timing in terms of distances and gravitational factors.

Hence, needed calculations could be simplified and systematized to permit approximate manual solutions for any operational condition. Correcting factors—such as atmospheric resistance, planetary and solar perturbations, and correction thrust vectors—could then be also applied manually. Such simplification has actually been achieved and reduced to navigational charts.

The assumption of complexity of required



MAN AND COMPUTER IN SPACE

ALEXANDER NYMAN

calculations is probably due to astronomical tradition and to present use of computers. They are built to be supplied with all pertinent data and then grind out the answer in phenomenally short time. But such a computer is, anyway, too big and complex to put into a space vehicle. Therefore, earth communications would have to be maintained, and freedom of space travel would be greatly limited.

Consider the alternative of a manned space vehicle furnished with astronautical and mathematical aids for space orientation in reference to the nearest planetary body. The closer he gets to it, the more accurate are the measurements and the more reliable are the simple calculations.

When the vehicle nears an area of space where it is subject to attraction of one or two other planetary bodies, it is quite possible to express their effect by the respective gravitational pull, which can be very simply calculated and then proceed to determine the disturbing effect by a not too difficult three-dimensional analysis. The distances are now great, and there is plenty of time to use all the necessary corrections and to make observational checks, just as the airplane navigator does, except that now the check data is derived from astronomical observations. They must be reduced to suitable terms of reference such as "Plane of the Orbit," "Ellipticity," "Parametric Distance," "Angle from the Perigee," and "Angle to the Orbits of Planetary Bodies."

The understanding of space relation is imperative for sound decisions. Verification by means of an astronautical aid visualizing this relation would be quite useful.

It is interesting to note how these mental processes are similar to those used in the design of a complex machine: First—sizing up the important factors. Second—arriving at approximate solution of prospective design. Third—introducing the corrections due to secondary factors. Fourth—laying out the design. Fifth—checking at every stage and correcting when necessary.

This may be called the method of approximation. It is used by every design engineer, particularly when novel constructional and operational features are introduced.

Applied to space travel it becomes an adventure of human spirit, adding zest and responsibility and the very active elements of perspicacity, ingenuity, and imagination, which have always been the keynote of human progress.

Those who travel into space deserve the best technical preparation as well as the most reliable equipment. To know where and how to steer the space vehicle should not depend on tenuous contact with earth observers. The means for ready space orientation are possible, and methods of determining the destination and the needed operational maneuvers can be worked out in a form that the astronaut will be able to use. It is essential that more effort and more thought be given to this problem.—END

Alexander Nyman is a former Air Force officer who was involved in early research on sensing devices for missiles and is now a consulting engineer for the Anderson-Nichols Company of Boston. He holds an M. S. degree from the University of Manchester in England and has had varied experience in design engineering, manufacturing, and research since leaving the military service.

What's the "mix"

to prevent the war that must not happen?

IN TODAY'S AMERICANA the word "mix" has a definition far more significant than any yet given by Webster. Simply put, it's America's recipe for peace—a careful blend of men and machines—of both manned and unmanned weapon systems, each designed to do a job the other can't, each indispensable for its own unique effectiveness.

Any potential enemy fully respects a missile's robot ability to deliver a payload to a target thousands of miles away; but he also knows that robots alone cannot deliver total retaliation. Some victories are achieved only by man's unique ability to capitalize on opportunity . . . make deci-

sions... and care about the result. Only the "mix" of both man and machine has retaliatory power, *plus* versatility, *plus* the will to win.

America's "mix" of both manned and unmanned weapon systems must be kept real enough to give a potential enemy constant pause. That's why today the Strategic Air Command has the Atlas ICBM *and* the B-52 bomber. That is why tomorrow, in the day of the Minuteman ICBM, America will have a high performance airplane—SAC's B-70 Valkyrie multi-purpose bomber... a 2,000 mph manned weapon system with global striking power.

This is the "mixed force" concept... the modern defense strategy arrived at by exhaustive analysis on the part of dedicated men in our government. The Mach 3 airplane is being developed to meet the military realities they foresee. Together with the missile, it provides the potent "mix" to prevent the war that must not happen.

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Biological evolution on the habitable planets of the universe may be the result of contamination left by visiting space travelers. A noted astronomer suggests that advanced life in the universe may have evolved from . . .

'COSMIC GARBAGE'

THOMAS GOLD

WHEN space travel becomes possible, we shall visit other planets in other solar systems in the course of investigations and explorations. Most of such planets would have unsuitable conditions on them for us to live there freely, and most of the visits would therefore only be passing exploratory ones. If such planets have no form of life on them, it is quite possible that they can be contaminated with some form of microbiology brought along by the space travelers. The low forms of life are, of course, enormously more adaptable to a great variety of conditions, and thus it is much more likely that the low forms of life will stay behind on the planets while the space travelers will not.

The beginning of a biological evolution on a planet may thus result from the contamination brought by the space travelers. A billion years later such a planet may then be in a position to spread the contamination further. If our galaxy is, as is now thought likely, some fifteen or twenty billion years old, a large amount of this activity may have gone on. Biology may be widespread cosmically, and the evolution to intelligence and with that eventually to space travel may be the essential means of starting the biological evolution suitable for each particular planet. Thus space travelers may have visited the earth a billion years ago and from their abandoned garbage forms of life have proliferated so that the microbes will soon have another agent capable of spreading them further afield.

The gigantic wastefulness and the apparent purpose of the process of natural selections have always been impressive. We now extend this to be part of a process on a still vaster scale in which natural selection assures the survival of those particular forms of microbiology which are adaptable enough and capable of leading to what we like to call higher forms of life in periods that are on the cosmical scale not too long. Clearly those microbes that do not possess this capability would not be able to spread, and the selection, though by a process which is rather slow, is a very strong one.

When we start to explore other planets both inside our solar system and in other regions, we shall find whether any biology that exists there uses the same screw sense as ours for its molecular structure. If in each case the system was the same and not the mirror image of ours and the number of cases was large, then we should be certain of a common origin of life in all of these places, since in the case of an independent evolution no reason could be found for singling out one of the two screw senses. So while it may be difficult to see clear evidence for the whole story, it is possible that we may see evidence which it will be hard to interpret in any other way.

In a universe constructed according to the principles of the steady-state theory, the processes that occur are the ones that are self-sustaining. If this is to be true also of biology, then it would be necessary to assure the contamination not only within each galaxy but also of the newly formed galaxies in the space between the older ones. Space travel between galaxies has to be possible for this, but of course this needs to be only quite a rare event. In a time of the order of about three billion years, the most advanced form of life occurring in a galaxy must be able to reach a neighboring one.—END

Thomas Gold, now chairman of the Department of Astronomy at Cornell University, was formerly at the Harvard College Observatory. Another interesting hypothesis he has proposed is the existence of deep dust drifts on the moon's surface. The above material is condensed from a presentation by Dr. Gold at a Space Scientists' Symposium in Los Angeles in late 1959.

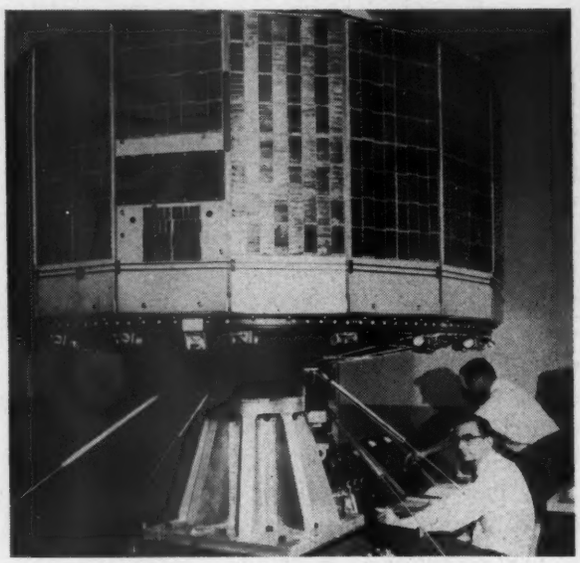
Speaking of SPACE

How Eye the Sky?

If anything has underscored the need for realistic acceptance by a timid national leadership of the military utility of space technology, it is the success of the now-celebrated Tiros I weather satellite, launched by the Air Force Ballistic Missile Division April 1 for the National Aeronautics and Space Administration.

Tiros, with its Army-RCA-developed payload, has dramatically demonstrated the feasibility of obtaining not only the meteorological patterns it was designed to relay earthward, but also the clear feasibility of the reconnaissance satellite for military purposes.

This demonstration (*see cut*), still primitive but suggestive of enormous high-resolution potential as the state of the camera art improves, weakens—and happily so—the argument of those well meaning observers who have denigrated the military utility of space technology.



RCA technicians give Tiros I a vibration test. Launched by USAF for NASA April 1, payload was built by RCA under Signal Corps direction.

As NBC's David Brinkley remarked: "Just like Rand-McNally." This photo was taken by Tiros I's wide-angle camera April 4. At left, the Nile River; center, the Sinai Peninsula and Red Sea; upper left corner, the Mediterranean and horizon.

To be sure, NASA, delighted with the many photos relayed by Tiros, has been careful to insist that no real ground detail is discernible in the photographs. And this is doubtless true now. But today's Tiros is cousin to tomorrow's Samos, the Air Force's projected reconnaissance satellite, which will probably be test launched quite soon. Samos and its partner project, Midas, the planned Air Force infrared early-warning satellite, have at long last begun to earn high-level acceptance as significant future additions to our deterrent posture. As many observers point out, our need to know vis-à-vis the Soviet Union's intentions and capabilities is far greater than theirs vis-à-vis us, by the very nature of open and closed societies. That our State Department is wary of any later-to-be-regretted deals with the Russians on outlawing military use of space was evidenced re-

FOR THE AIR FORCE, MSVD engineers test three-axis stabilization system. Lamp simulates Sun. Similar system will assure station-keeping capability in orbit of U.S. communication satellites.

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Progress in space vehicle navigation

As space vehicles probe further and further away from the Earth, and as their missions become more and more complex, the need for accurate, high-precision space navigation and control becomes increasingly vital.

General Electric Missile and Space Vehicle Department engineers are now developing and testing space vehicle control equipment for the 24-hour-orbit communication satellite program. They have already designed and flight-tested on space vehicles a three-axis stabilization system as well as orbit computation and correction techniques. Using the Earth and Sun as reference points, this MSVD three-axis system successfully controlled the attitude in space of U.S.A.F. *Atlas* and *Thor* re-entry vehicles during a major portion of their ballistic flights. The control accuracy attained on these flights could be duplicated on flights further into space, using other planets and stars as check-points.

For more information about MSVD's space navigation and control work for the Air Force and its other contributions to U.S. space technology progress, write to Section 160–73, General Electric Missile and Space Vehicle Department, Philadelphia 4, Pennsylvania.

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Fixed in "motionless" equatorial orbit 22,000 miles from earth, communications satellites like these will yield the first down-to-earth results from space.

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Clear, strong, line-of-sight, high frequency signals will enlighten the earth . . . enter every house, hut, vehicle or wilderness spot on earth . . . penetrate all barriers of geography and nationality. Wrist radios, global electronic mail delivery, and auto-phones will bring instant, constant and economic communication. And all will be carried on ethereal waves as unstoppable as starlight . . . to reshape the future of our earth.

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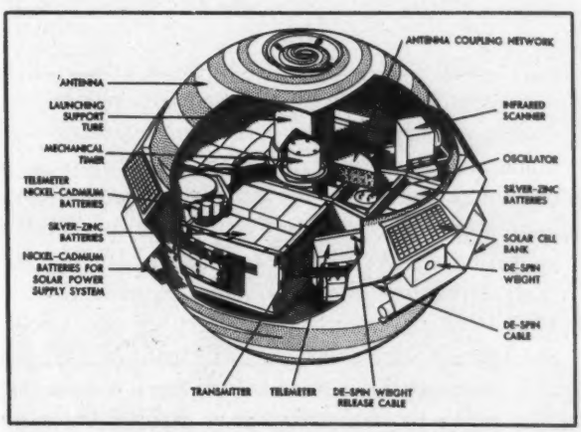
freshingly by Secretary of State Herter's cautious replies to newsmen's questions on the matter at a press conference that followed closely on the Tiros launch.

There is further irony to the Tiros success. Instead of strong congressional interest in the national security significance of the picture-taking satellite, the reaction, at least in the House Committee on Science and Astronautics, seemed completely in terms of recouping national prestige. National prestige is vital, of course, and has been stressed here often and with conviction, but it is only a part of the total picture. In an appearance before the House committee after Tiros, NASA Administrator T. Keith Glennan, flanked by a large mockup of the satellite, was hard put to fend off the entreaties of several committee members to assure them that we had now nearly caught up with the Soviets. This is not the point at all.

The point, which Mr. Glennan's position almost requires him *not* to make, is that we must *first* examine space technology's potential in terms of its contribution to our security and *then* worry about purely scientific objectives and international prestige. Our scientific achievements in space are considerable, but so are the Russians', no matter how many radiation belts we have discovered.



Cutaway of Transit I-B, navigation test satellite launched April 13 by USAF with Navy-developed payload into approximately 400-mile orbit. Launch marked first use of new Thor-Able-Star booster combination. Payload weighs some 265 pounds contained in 36-inch-diameter sphere. Objective of Transit project is development of reliable global all-weather means of fixing undersea, surface, and aircraft positions. Satellite would transmit signals from which earth observers would determine the positions of their craft.

Maj. Gen. Donald N. Yates, USAF, designated Deputy Director, Defense Research and Engineering for Ranges and Space Ground Support.

To Mr. Glennan's credit, he has been a forceful leader of his agency, and although there has been some congressional criticism of what has been called a leisurely NASA program pace, the NASA Administrator has been careful not to join the chorus of those who either totally deny military space missions or who would absorb the military space effort into NASA.

Since the original Space Act provisions for a National Aeronautics and Space Council and a Civilian-Military Liaison Committee have proved generally unworkable (partly because they were never really put into operation), the new approach in national coordination is to be a formal Aerospace Activities Coordinating Board, co-chaired by the Deputy Administrator of NASA and the Director of Defense Research and Engineering. These two officials, according to Mr. Glennan, will be assisted by officials from NASA and the Department of Defense and will try to work out decisions that up to now have been made on an *ad hoc* basis. The prestige of the co-chairman is hoped to assure the board's authority.

Mr. Glennan's testimony before the House Committee was quite significant and showed his political sagacity. Pointing out that he personally had no problem in getting to the President on space decisions, he opposed creation of any "space czar," as an unnecessary layer of authority, and any military applications division within NASA. He made one suggestion, which the President, whom he describes as easily accessible to him, might consider seriously—designation of a single

management system for space within the Department of Defense.

As matters stand now, the great strength of NASA is its unitary quality, and the great weakness of the military is the continued splintering of mission and authority in space areas. But there is some progress toward "space unification" in the Department of Defense, however. A recent example is the designation of USAF Canaveral boss Maj. Gen. Donald N. Yates as Deputy Director of Defense Research and Engineering for Ranges and Space Ground Support, directly under Dr. Herbert F. York, Director of Defense R & E.

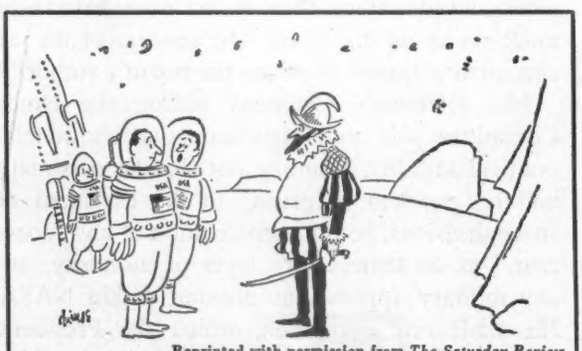
The movement toward the inevitable—a realistic acceptance of a military space mission and designation of the Air Force to handle the mission—is under way but will doubtless have to wait until January 20, 1961.

Whither Space Medicine?

Another vital area of space technology—aerospace medicine, the life science techniques to ensure human survival in space—has also become a focus of strong interest in the effort to set the US space house in order. NASA's recent announcement that it would establish its own Office of Life Sciences has given rise to fears of duplication of the already existing and long-standing military capability in this area and splintering of the limited number of expert personnel.

NASA says that it needs a basic research capability in space biology, and many military aeromedical people will grant this. But a principal rationale used to back up the formation of the new NASA division is the amazing argument that since the military mission remains unspelled out, the military may soon have *too much* capability.

If that argument had been used in the early days of aviation, safe, purposeful flight would not have risen above a few thousand feet.



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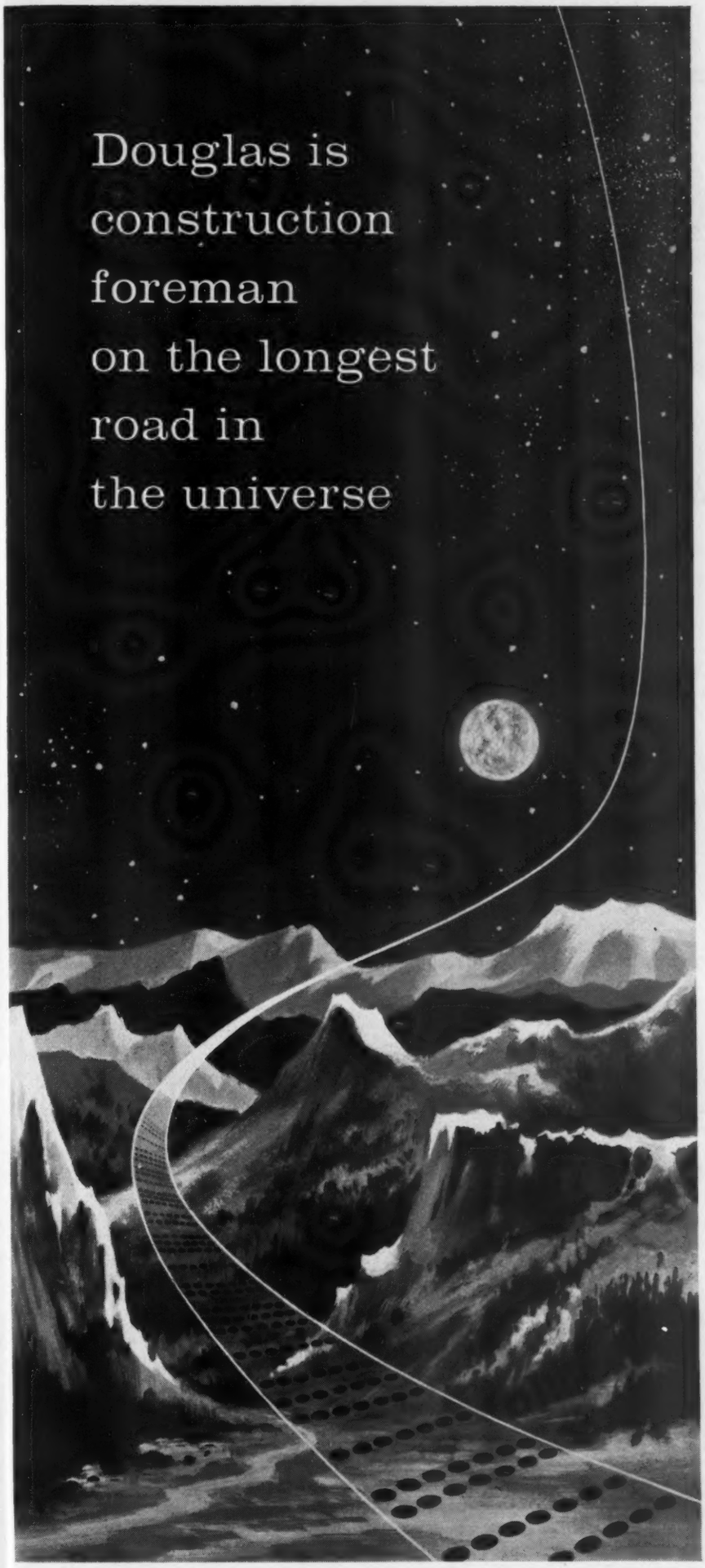
"Technologically speaking, I think we're out in front."

Space Capsules

For an authoritative survey of the human pilot's role in space exploration, see the Winter 1960 *Quarterly Review of the Society of Experimental Test Pilots.* Write to the Secretary, SETP, 44919 Cedar Ave., Lancaster, Pa. . . . The thorny questions of the *Psychophysiological Aspects of Spaceflight* will be explored by a battery of top aeromedical experts May 26 and 27 at San Antonio, Tex. The meeting is sponsored jointly by *Southwest Research Institute* and the *USAF Aerospace Medical Center.* . . . For $5, by writing to the *Office of Technical Services, Department of Commerce, Washington 25, D. C.,* you can purchase an excellent listing of *USAF Air Research and Development Command basic research* activities, scientific investigators, and descriptions of projects. . . . Although acknowledging American discovery of the Van Allen radiation, *Pravda* for March 23 says that *"Soviet scientists can claim priority in discovering the outer belt* and have played an important role in studying the inner one. Author of the *Pravda* article, Prof. A. Lebedinsky, an eminent astrophysicist, says that not until *Sputnik III measurements* were made was it possible to determine boundaries of the inner belt. . . . An egg-shaped container to enable spacemen to work outside of spacecraft is suggested by *Dr. Stanley L. Roscoe, Hughes Aircraft Company human factors specialist.* . . . *V. Davydov,* Scientific Secretary of the USSR's Shternberg State Astronomical Institute, suggests in *Komsomol'skaya Pravda* for March 6, that Mars may prove to be encased in a mantle of ice and that the "canals" may be *cracks in the ice caused by internal pressures*—"Marsquakes". . . . Contrary to the jagged, highly defined surface of the moon to which we have become accustomed in artists' conceptions, *our satellite is apparently much flatter,* and indeed would be easy to get lost on because of a lack of "moon marks," according to Air Force-sponsored moon-mapping techniques developed at *Britain's University of Manchester and France's University of Toulouse.*

—WILLIAM LEAVITT



Revolutionary new "pathway" concept lets the operator "drive down the street" to anywhere—promises major civilian benefits

Six years ago, recognizing that development of advanced vehicles was outpacing man's ability to control them, the Military assigned Douglas the job of doing something basic about simplifying instruments.

This project evolved into ANIP (Army-Navy Instrumentation Program) with Douglas coordinating the efforts of a highly-specialized industry team.

Result has been a remarkable control panel design—a *visual* highway down which the operator drives his aircraft, spaceliner, submarine, tank or ship with perfect confidence, even when visibility is zero. Also provided is a topographical map which gives him *visual* current information on his position and the reach of his fuel supply.

Civilian application of this new concept could well extend to ships, airliners and even trucks and cars which will *drive themselves* down this "electronic road."

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MAY 1960

Overseas bases would be absolutely indispensable in either nuclear or nonnuclear limited war, writes a leading analyst of current military strategy. But some of the arguments that are used to support the need for them should be examined in . . .

Another Look at

THE IMPORTANCE OF OVERSEAS BASES

Albert J. Wohlstetter

IN A RECENT article in AIR FORCE ["The Importance of Overseas Bases in Unlimited War," December 1959] Maj. Gen. Dale O. Smith, Commander of the 313th Air Division on Okinawa, and a well known authority on strategy and military doctrine, defends overseas bases against their depreciators. He states, among other things:

- Withdrawal from overseas bases and retreat to that "old deceptive girl . . . fortress America," could be fatal to the free world.
- As launching bases for missiles, they present the aggressor in unlimited war with a dilemma: He either must destroy them first, in which case their destruction would provide added warning time to the continental United States, or he must launch his missiles to achieve simultaneous impact on targets overseas and in the United States, in which case the enemy missiles bound for our continent would be detected in time for us to launch our overseas missiles toward the enemy launching sites so as to catch them before they are fired at the overseas bases.

Since General Smith cites an article of mine* to illustrate the depreciation of overseas bases (it is, in fact, the only one cited), I hope I can use the occasion to correct this impression: to make clear just where we agree and where we do differ, and to elaborate on some questions of offense strategy that are of general interest and have been rather generally misunderstood. I am grateful to General Smith for providing an opportunity for me to emphasize several points which are made concisely in the article he cited and at greater length in a more extended version of my article published, with the same title, as P-1472, The RAND Corporation, November 6, 1958.*

Some of these points I hope he will find reassuring.

On the Importance of Overseas Bases

First, I do not depreciate the value of overseas bases. I regard them as indispensable. Furthermore, my estimate of the character and occupation of that "old deceptive girl . . . fortress America" coincides precisely with that of General Smith. In the article (short version), I dealt at some length, as I made explicit: ". . . with only *one* of the functions of overseas bases: their use as a support for the strategic deterrent force" (*page 229*). But I did add, briefly:

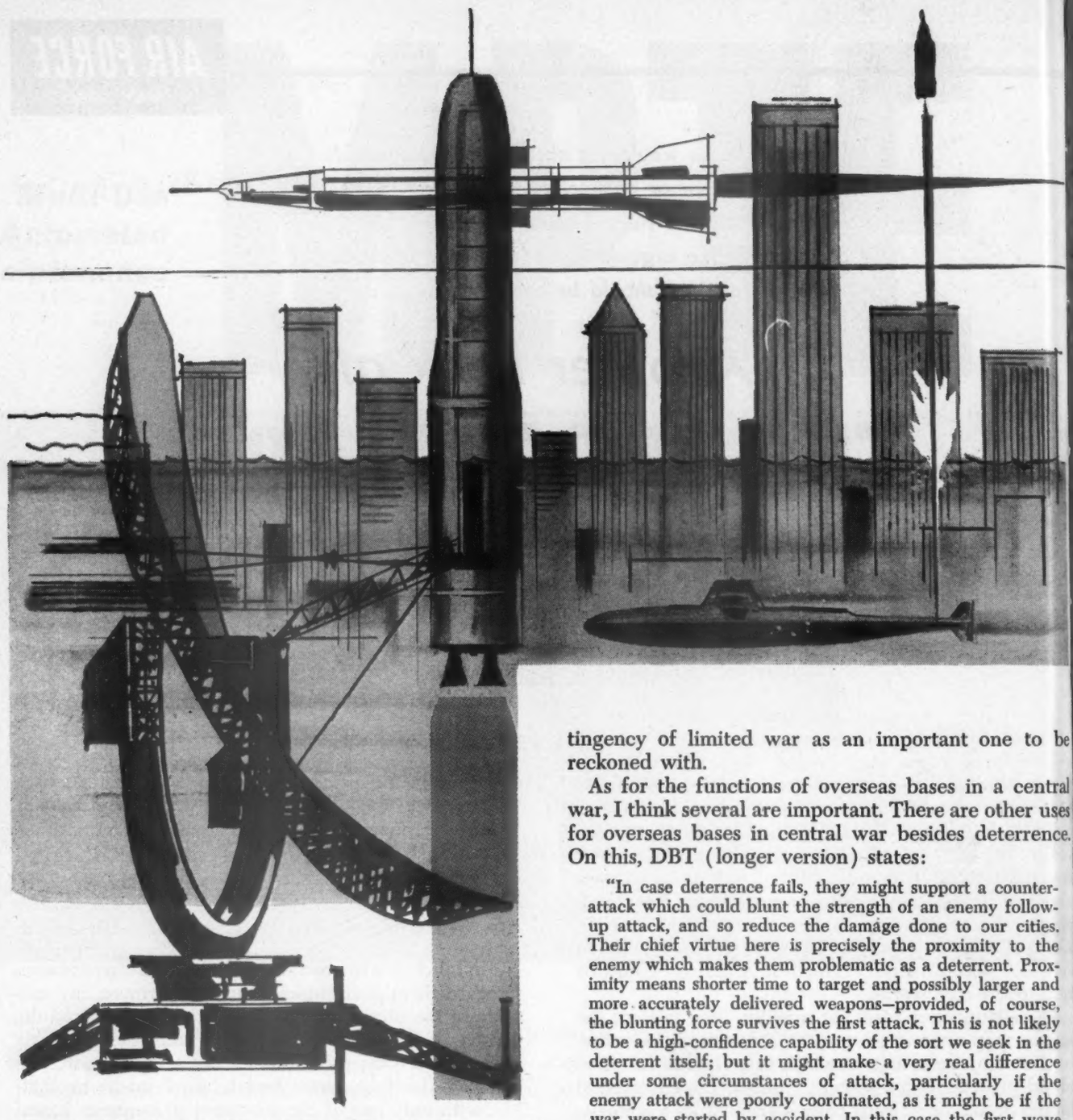
> "They have a variety of important military, political, and economic roles which are beyond the scope of this paper. Expenditures in connection with the construction or operation of our bases, for example, are a form of economic aid and, moreover, a form that is rather palatable to the Congress. There are other functions in a central war where their importance may be very considerable and their usefulness in a limited war might be substantial" (*pp. 229, 230*).

On the use of overseas bases to support operations in a limited war, the longer version of the article goes on to say:

(Continued on following page)

*"*The Delicate Balance of Terror,*" Foreign Affairs, January 1959; AIR FORCE, February 1959.*

**The more extended version of the article was not easily available to General Smith on Okinawa. The shorter version, while I believe quite correct, was too brief to permit emphasis on the points to be elaborated now. In what follows I shall refer to the RAND P-1472 as "DBT—longer version" and to the AIR FORCE and Foreign Affairs form of the paper as "DBT—shorter version."*



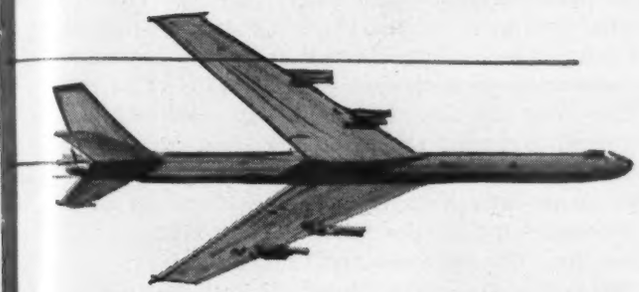
"Their importance here is both more considerable and likely to be more lasting than their increasingly restricted utility to deter attack on the United States. Particularly in conventional limited wars, destructive force is delivered in smaller units and, in general, requires a great number of sorties over an extended period of time. It is conceivable that we might attempt the intercontinental delivery of iron bombs as well as ground troops and ground support elements. The problem of intercontinental vs. overseas bombers is mainly a matter of costs, provided we have the time and freedom to choose the composition of our force and our budget size. But there would be enormous differences in costs between distant and close-in repeated *delivery* at a given rate of high explosives" (*p. 31, DBT—longer version*).

In short, I think overseas bases have a very great value in both nuclear and nonnuclear limited wars, a value most obvious in the nonnuclear case. Moreover, while I think central war is our most fundamental problem as I indicate in that article, I regard the contingency of limited war as an important one to be reckoned with.

As for the functions of overseas bases in a central war, I think several are important. There are other uses for overseas bases in central war besides deterrence. On this, DBT (longer version) states:

"In case deterrence fails, they might support a counter-attack which could blunt the strength of an enemy follow-up attack, and so reduce the damage done to our cities. Their chief virtue here is precisely the proximity to the enemy which makes them problematic as a deterrent. Proximity means shorter time to target and possibly larger and more accurately delivered weapons—provided, of course, the blunting force survives the first attack. This is not likely to be a high-confidence capability of the sort we seek in the deterrent itself; but it might make a very real difference under some circumstances of attack, particularly if the enemy attack were poorly coordinated, as it might be if the war were started by accident. In this case the first wave might be smaller and less well organized than in a carefully prepared attack. The chance of even some of our unprotected planes or missiles surviving would be greater. Moreover, a larger portion of the attacker's force would remain on base, not yet ready for a following attack. Using some portion of our force not in retaliation but to spoil the follow-up raid by killing or at least disrupting the matching of bombers with tankers, bombers with bombers, bombers with decoys, and bombers with missiles could reduce both the number of attackers reaching our defenses and the effectiveness of their formation for getting through. It would be a fatal mistake to count on poor planning by an aggressor, but, given the considerable reduction in damage it might enable, it is prudent to have the ability to exploit such an error" (*pp. 29, 30, DBT—longer version*).

I added the qualification that a force capable of blunting a poorly started aggression might suggest an intent to strike first *unless it were coupled with a very strong second-strike capability, that is, the ability to*



strike back even after a well coordinated surprise attack. This is an important proviso since guaranteeing a second-strike capability is the most critical item on our agenda for the 1960s—one which is neither automatic, as the believers in the theory of a stable balance of terror think, nor easy, as the holders of the Minimum Deterrence theory suggest. Simply putting soft fixed missiles on overseas bases will not solve the complex problem of deterrence. They would not be likely to survive a well coordinated attack by the aggressor. It could actually worsen the problem of stability—unless at the same time we develop a very strong second-strike capability in some other way.

The quoted passage has become increasingly relevant with the growing currency of the Minimum Deterrent theory. Minimum Deterrence theorists agree that deterrence is important but reject any attempt to fight a war, or even to survive and to alleviate the damage to our cities in case deterrence fails. They regard such attempts as unnecessary because they feel deterrence can be made very certain with a rather small expenditure of effort. And they regard a capability to limit damage to ourselves as actually bad because they think it necessarily provocative and destabilizing. I strongly dissent from the Minimum Deterrence theory as I suspect General Smith does also. Deterrence is vital and feasible but will require a great deal of effort, and even a good deterrent can fail. Therefore, we can make good use of preparations against the contingency of failure. Such insurance, I believe, need *not* be destabilizing.

A critique of the popular Minimum Deterrence theory, however, is another and a longer story. The point here is that, like General Smith, I think deterrence is necessary but not enough. To limit damage and to fight a war in case deterrence fails, overseas-based forces, along with the active and passive defense of our cities, can serve a very useful role.

However, for the deterrent function itself, I indicated overseas bases continue to have some use:

> "... even with the projected force of aerial tankers, the greater part of our force, which will be manned bombers, cannot be used at all in attacks on the Soviet Union without at least some use of overseas areas" (*DBT—shorter version, p. 224*).

Ground refueling, poststrike and, in some cases, even prestrike will be essential for our bombers for some time to come.

It is apparent from the above that, while General Smith and I may weigh the importance of various uses of our overseas bases differently, we are in agreement that overseas bases are important.

A Dilemma in Attacking Bases Overseas and on the Continent?

Yet, we do have some disagreements. The most important stems from an assumption, implicit in General Smith's argument, that the United States should, or would fire ballistic missiles from overseas areas or from the ZI on the strength solely of radar detections. We disagree totally here. But before turning to our disagreement on this central question, it would be good to analyze the dilemma of coordination which General Smith and many other responsible strategists suggest is posed to an aggressor by the mere presence of soft IRBMs overseas.

The reader will recall the dilemma suggested. Even in a coordinated attack, the enemy must, we are told, either (1) give extra warning to the continent, or (2) never complete his salvo (specifically, that part of it directed overseas). Our differences on the subject of this suggested dilemma can be settled by calculation, using only public information. Moreover, even if we supposed, for the sake of the analysis, that we were to open fire on the evidence of radar blips alone (even on that of a *single* detection), the calculations do not support the view that there is a dilemma.

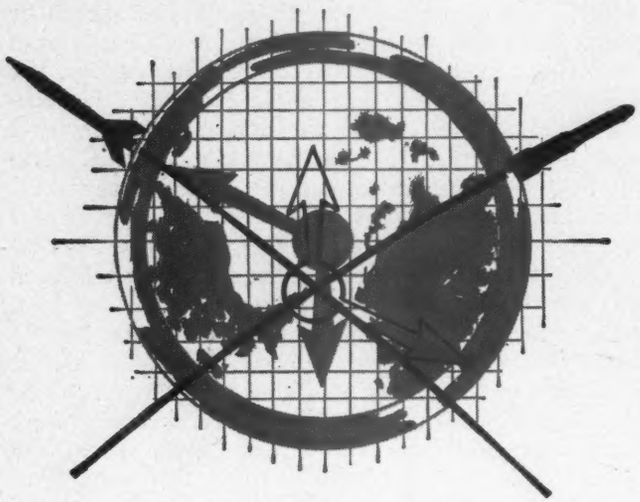
Therefore, in this section I shall put aside the critical question as to whether we should or would fire ballistic missiles on the strength of radar indications. Let us assume we shall and examine this rather widely accepted dilemma of coordination.

Take first the case proposed by General Smith in which the Russians launch a missile from Vladivostok to some target near San Francisco, such as Hamilton AFB, and expect to follow it with another missile from Vladivostok to a target on Okinawa, timed to arrive at the launch base as the first missile lands in the vicinity of San Francisco. A missile can be sent from Vladivostok to the target at San Francisco on any of a great variety of trajectories which would not be within the line of sight of a radar placed on Okinawa. However, this missile certainly could be seen from the BMEWS station at Alaska. Could it be seen soon enough for the Okinawa base to launch its missiles toward Vladivostok and to destroy the Vladivostok target before it launches missiles at the Okinawa complex itself?

If the Russians launch their missile on a flat trajectory, total flight time to the San Francisco area would amount to some twenty-four minutes. If we make the arbitrary but generous assumption that the lower beam of the ballistic missile radar has a zero degree angle of elevation or, in other words, that the only limitation is the horizon, radar intercept would take place in eleven minutes after launch, leaving thirteen minutes before impact. And three minutes before the launching of the enemy missile against the Okinawa target. In these three minutes, in order to prevent launching of the enemy missiles toward Okinawa, we would have (1)

(Continued on following page)

to interpret the radar signals and recognize them as a raid, (2) get the decision made to retaliate, (3) have this decision transmitted and received, (4) prepare, countdown, and launch our own missiles from Okinawa, and (5) cover the trajectory from Okinawa to the Vladivostok target. However, our time of flight alone (assuming we also use a short low-angle trajectory) is very considerably longer than the three minutes allotted. To put it briefly, it is infeasible.



If we vary this case slightly by having both sides use minimum energy rather than low-angle trajectories, it remains true that our time of flight alone exceeds the interval between detection of the San Francisco-bound missile and the launching of the missile toward Okinawa.

Of course, it would be possible to put another radar in between Okinawa and Alaska, for example, in Northern Japan, which would detect the missile launched from Vladivostok toward the San Francisco area a few minutes sooner. But the example proposed is arbitrary, and the enemy need not launch his missile at the San Francisco target from Vladivostok. In fact, flight times would be considerably shorter if he launched them from Kamchatka or Anadyr, which are closer. Flight time from Anadyr to a target in the vicinity of San Francisco on a low-angle trajectory would amount to some sixteen minutes. For the purposes of detecting such a missile our Alaskan stations are almost ideally placed. But if we again assume that only the horizon is the limit, detection would take place in four minutes, leaving twelve minutes to impact. And only two minutes until the enemy launches his missile against the Okinawan bases from Vladivostok.

We have, surely, some freedom as to where we may locate our missile bases and where we might build our new radars. But the enemy has an even greater freedom as to the choice of launching sites within his national boundaries and also in the Atlantic and Pacific.

So far we have only considered an example of launching against bases at San Francisco and Okinawa. However, we should consider various attacks from a multiplicity of hypothetical launching sites against a multiplicity of targets. We might vary the overseas locations of (1) our missiles or (2) our radars. The enemy can vary (1) the size or maximum range of the missiles he uses, (2) his missile trajectories, and (3) his launching point and target pairings. This takes a good deal more calculation, but it is necessary to give a fair test to the hypothesis that there is a dilemma.

A variety of such map exercises fails to sustain the view that the time from the first detection will be enough to disrupt the opening salvo against us. When such exercises are run through, the typical results for an enemy attack using land-based missiles only and low-angle trajectories leave a maximum of twenty minutes or so between first detection and impact; for attacks using missiles launched from submarines on station, at most about ten minutes even if we assume the launchings are detected without delay.

In either case, the entire sequence of enemy firings against overseas bases can be completed in less time after the first detection than would be involved in time of flight of our counterattacks. The inadequacy of a strategy in which we depended on soft fixed missiles and ballistic missile early warning would be even more obvious, of course, if we considered not just flight time but, more realistically, time of preparation, and especially, time to interpret, to decide, and to transmit the decision.

In fact, the dilemma seems plausible only because we forget how short these flight times are, and, in particular, because we forget that the enemy doesn't need to fire from a single point, like Vladivostok, toward widely dispersed points, like Okinawa and Hamilton AFB, at San Francisco. The selection of launch points offers a natural way of compressing total time of flight as well as the interval between first and last launch for a simultaneous impact salvo. This makes extreme lofting of trajectories over short distances quite unnecessary.

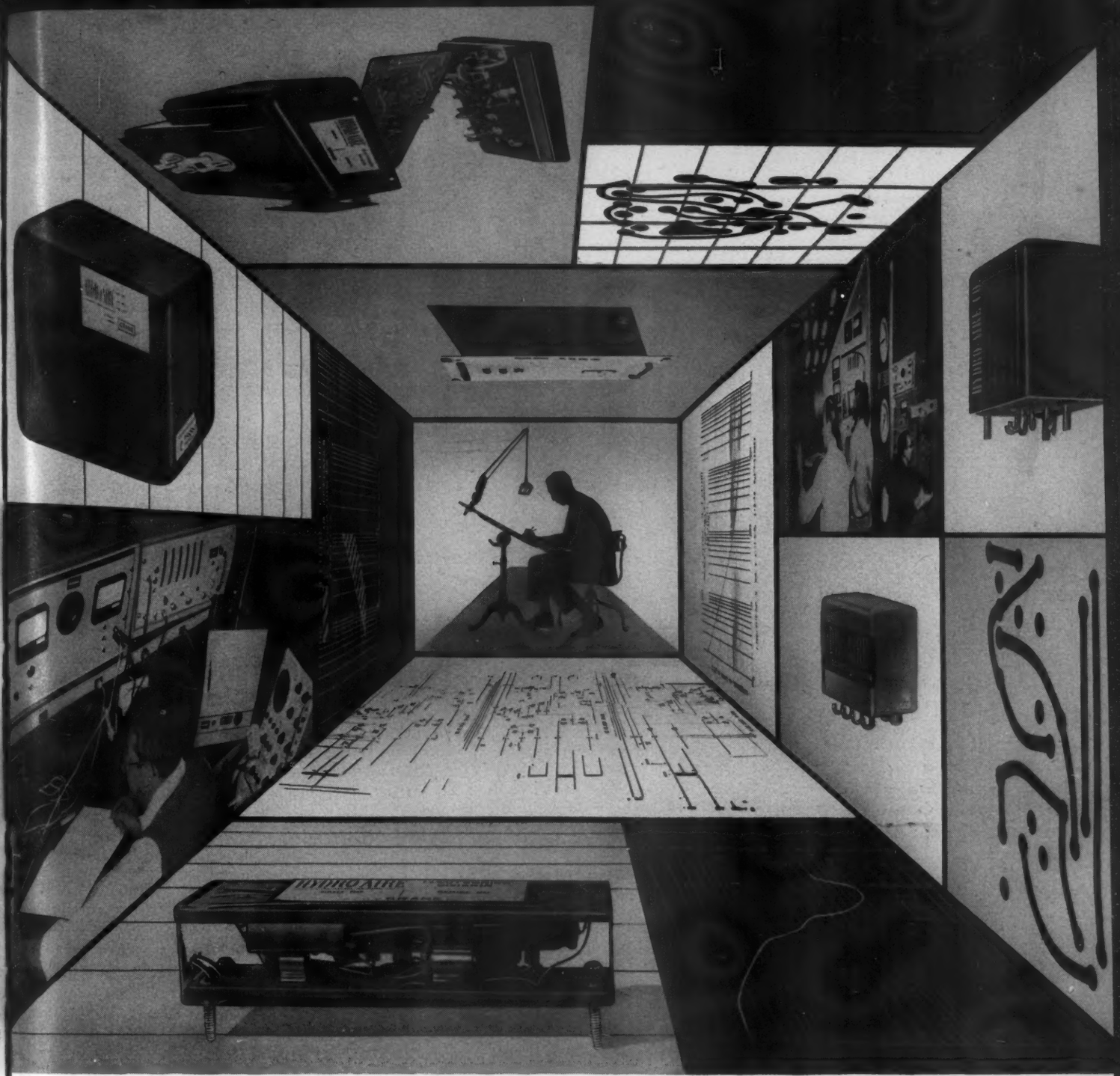
General Smith agrees that for the Soviets to compute a time for the ballistic missile salvo presents no major problem. We would agree then that we should not rely on poor enemy coordination for deterrence. The calculations I have described make clear that a well coordinated simultaneous time-on-target strategy does *not* permit time enough for disruption.

The Other Horn of the Supposed Dilemma

So far we have discussed only the simultaneous impact strategy and the amount of warning overseas bases might get from radar detection of missiles bound for targets in the United States. If the enemy thought seriously that we would fire on the basis of radar warning, his strategy would involve not simultaneous time on target, but an essentially simultaneous penetration of all warning barriers. In this case, well coordinated firings against overseas bases add no extra warning to that available from attack on continental bases. In other words, the second half of the dilemma, like the first, is not a real one.

First consider radar warnings of ballistic missiles attacking Okinawa or other overseas bases. In most overseas areas, and in Okinawa, too, there are, of course, no ballistic missile radars. It would cost over a

(Continued on page 79)



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quarter of a billion dollars to put in one such radar and its associated communications and other systems. Even if we neglect "noise" problems, it is doubtful that such a radar would guarantee any significant detection time at Okinawa of missiles launched against Okinawan targets. They might be launched from much closer in than Vladivostok: from China, for example, or from a submarine. Even if there were a radar there, detection would hardly precede bomb impact by very much.

Warning at Okinawa by radar penetration by missiles on the way there could be timed simultaneously with radar penetration by missiles on the way to the continent. This clearly would provide no extra warning to the bases on the continent. In fact, report of the bomb impact at Okinawa itself, so long as it was timed to coincide with or follow radar warning of the Hamilton AFB-bound missiles, would add no information needed for our decision to respond, if we accept the basic premise of the dilemma that radar warning of the Hamilton AFB-bound missile itself will trigger the most momentous of all decisions—the decision to wage World War III.

Analogous comments are appropriate for most overseas locations. To sum up this second half of the dilemma: Against an opponent willing to fire missiles on the basis of radar detections alone, the best strategy of attack is to penetrate warning simultaneously. In this case, overseas areas have less warning time than might be available to deep continental bases. And the overseas areas do not add to the warning available to bases on the continent.

The Decision to Fire Missiles

In analyzing the first half of the supposed dilemma we showed that a well coordinated simultaneous time-on-target strategy could be completed without interruption by counterfire from overseas bases. But if the time after detecting the first enemy missile is too short for us to prevent the launching of his last missile in a well coordinated salvo, isn't there enough time to get our own missiles off before his warheads explode at our bases? If so, this could mean saving our ZI-based missiles as well as those based overseas.

In the event of a simultaneous time-on-target salvo, continental bases have as much time between detection of the first enemy missile and its impact as the overseas bases. And more time than the overseas bases in case the salvo is scheduled for simultaneous detection. But to answer this question we have to consider seriously much more difficult matters than the measurement of times on trajectory and the like. We have to consider the decision problem on firing missiles, which we have so far deferred. On this subject, I stated:

> "The decision to fire a missile with a thermonuclear warhead is much harder to make than a decision simply to start a manned aircraft on its way, with orders to return to base unless instructed to continue to its assigned target. This is the 'fail-safe' procedure practiced by the US Air Force. In contrast, once a missile is launched, there is no method of recall or deflection which is not subject to risks of electronic or mechanical failure. Therefore, such a decision must wait for much more unambiguous evidence of enemy intentions. It must and will take a longer time to make and is less likely to be made at all. Where more than one country is involved, the joint decision is harder still, since there is opportunity to disagree about the ambiguity of the evidence, as well as to reach quite different interpretations of national interest" (*DBT—shorter version, p. 226*).

There are many authoritative statements in the public press which suggest that the United States is not likely to make so momentous a decision on the basis of radar information. For example, Gen. Thomas S. Power, Commander in Chief, Strategic Air Command, in recent testimony before the House Subcommittee on Appropriations, states:

> "I cannot see for the foreseeable future how we can launch them [ballistic missiles] on the basis of radar detection alone. This is why their sites have to be hardened, and this is why they must be complemented with a manned bomber force that we can get off the ground and ensure survival."*

Other high military figures, for example, Vice Adm. John H. Sides, the Director of the Weapon Systems Evaluation Group in the Office of the Secretary of Defense, have publicly stated much the same thing. And both a past and the current President of the United States have recently made very emphatic statements on the necessity for the President himself to participate in any decision whatsoever to use nuclear weapons. The decision to fire a missile is a decision to fire nuclear weapons.

It is, in fact, the decision for World War III.

It is not, then, United States policy to let the decision for World War III be made by a piece of electronic equipment on the evidence of some electromagnetic signals. I think our policy in this respect quite sound. Radar *or infrared signals* might be reduced or suppressed, or they might be confused by "noise," that is, in General Power's phrase, "spurious signals"—either man-made like the Sputniks he mentioned or simply part of the variable natural background.

Every sensing system with a significant probability of detecting a raid of a given magnitude has a finitely probable false-alarm rate that goes with this capability. And above all, the time available for receiving such signals, transmitting them, processing them, and using them for decision is likely to be terribly short and

(Continued on following page)

**A more extensive quotation from General Power's testimony is useful here.*

"Let us imagine these BMEWSs have been built, and it is 2:30 in the morning. The man operating the BMEWS has me on one end of the telephone and [the Commander of the North American Air Defense Command] on another circuit. The conversation goes something like this:

" 'The radars have picked up 1,000 objects. The computer says they are ballistic missiles, and they will impact in the United States.'

"I have about twelve minutes left because it took him at least three minutes to do that.

"What am I going to do?

"I can launch the alert force.

". . . I will do that without any hesitancy because I know that, if this turns out to be a spurious signal, no harm is done. . . . But in this time period we will also have a button whereby I can send the ICBMs on their way. I will have missiles at Vandenberg Air Force Base, Cheyenne, Offutt, Fairchild, and—I don't know whether Topeka will be in at that time or not, but let us assume it is.

"I can press that button and send the missiles on their way.

"Do I want to do it, assuming I had authority to do so? Because sure as shooting, in another two or three minutes, this lad will say, 'I am sorry, but those blips have disappeared off the scope.' They were Sputniks, interference, or something like that. Therefore, I say the missile will have to ride out the attack."

possibly nonexistent. The time between impact and first detection by radar of land-based missiles launched along fixed flat trajectories might vary between zero and two minutes overseas and between thirteen and sixteen minutes in the United States. Flight time of missiles launched from submarines on station against bases deep in the United States comes to about ten minutes; against coastal or island bases, much less.

For such reasons, the security of our retaliatory force must not rely on warning and timely reaction as its sole or principal defense. This is true for our bombers as well as our missiles even though the bombers can be committed to the air more swiftly since this commitment can be reversed. In spite of this advantage, the Air Force has recommended a mode of protection for the B-52s which does not depend on warning; namely, to keep a fraction up in the air at all times. In fact, it is now widely recognized that in the future we will have to emphasize modes of defense of our retaliatory force such as mobility, concealment, extreme hardness, and dispersal, which do not depend for their success on receiving warning.

The remarks on the coordination of ballistic attacks on our overseas bases which General Smith cited were made in the context of an analysis of the decision to station soft fixed Thors and Jupiters overseas. I said:

> "... we must face seriously the question whether this move will in fact assure either the ability to retaliate or the decision to attempt it, on the part of our allies or ourselves. And we should ask at the very least whether further *expansion* of this policy will buy as much retaliatory power as other ways of spending the considerable sums involved."

A justification for expanding this policy in terms of the coordination dilemma will not hold water. Soft fixed missiles will not assure retaliation against a coordinated attack. And in judging whether a dollar spent in this way or on some alternative is more productive for the specific purpose of assuring retaliation in the face of a well planned assault one must take into account the fact that the overseas bases are open to a wider variety of attacks with little or no warning than our ZI bases and to attacks with larger payloads and greater accuracies.

Let me expand a little on the continuing relevance in the 1960s of these special problems of overseas bases. In order to minimize warning, the enemy has to restrict the size and composition of his initial attack. For example, he may restrict it to ballistic missiles or even to submarine-launched ballistic missiles, which are in general less accurate and more limited in payload than aircraft. Since we may survive his initial warningless attack, for example, by shelter, one possible tactic of the enemy is immediately to follow his ballistic missile attack with bombers, using the missiles essentially to pin us down until the bombers arrive. The smaller the detection time we have against bombers, the more feasible is this pin-down tactic.

Overseas bases suffer from the disadvantage that they are subject to an initial missile wave with greater accuracies and bomb yields (making blast protection harder), and the missiles also can be followed by bomber attacks more quickly (making the pin-down requirements less severe). On some overseas locations, no substantial warning is feasible against even the bomber attack so that these could be used on an initial wave.

In short, the fact which General Smith mentions, that overseas bases in general have only a small interval between first detection and arrival at their base of enemy manned bomber attacks, has significance even in the ballistic missile age.

Overseas bases are of great importance, but not all arguments to support their importance are right. Among those that are wrong is the notion that in the face of a well coordinated enemy missile attack, missiles placed overseas without protection are sure either to retaliate and disrupt the opening enemy salvo or to provide extra warning for the continental US. They can guarantee neither one.

But deterring a well coordinated thermonuclear attack on the US, while vital, is by no means all we want to do. We must have insurance that we can limit damage in case deterrence fails whether by accident or deliberation. And overseas bases can help disrupt the poorly coordinated attacks that are now likely in the event that the war starts by accident (and this, in turn, if we have a good high-confidence deterrent, is more likely to be the way a war starts if it starts at all). Finally, the overseas bases play a principal role in limited wars.

"The Delicate Balance of Terror," in opposition to those who think deterrence in the 1960s is automatic or easy to come by, argues that, while feasible, it will be hard and it will require a considerable effort. As for overseas bases, while these have continuing value and a variety of functions, the article stated that assuring retaliation against enemy attack would be particularly difficult close in.

We must be prepared for an increase in the weight of attack which the Soviets can deliver with little warning and the growth of a significant Russian capability for an essentially "warningless" attack. This is true for the ZI as well as overseas, but the overseas bases are subject to a wider variety of attacks with shorter warning and with larger yields and greater accuracy than bases at intercontinental range.*

This is a statement of fact. It is not inconsistent with the fact that overseas bases continue to have many uses and, like our alliances themselves, are indispensable.—END

*I am very grateful to Mr. Michael Arnsten of the RAND Corporation for advice and assistance in the analysis of ballistic missile attacks described in this paper.

Dr. Albert J. Wohlstetter is Associate Director of Projects for the RAND Corporation and one of the nation's leading strategic analysts. He was adviser to the US delegation at the Geneva conference on the danger of surprise attack in 1958. Dr. Wohlstetter, who was educated at the City College of New York and Columbia University, wrote "The Delicate Balance of Terror" which appeared in the February '59 issue of this magazine, after first appearing in the January 1959 issue of Foreign Affairs. *Dr. Wohlstetter is also the author of many other studies.*

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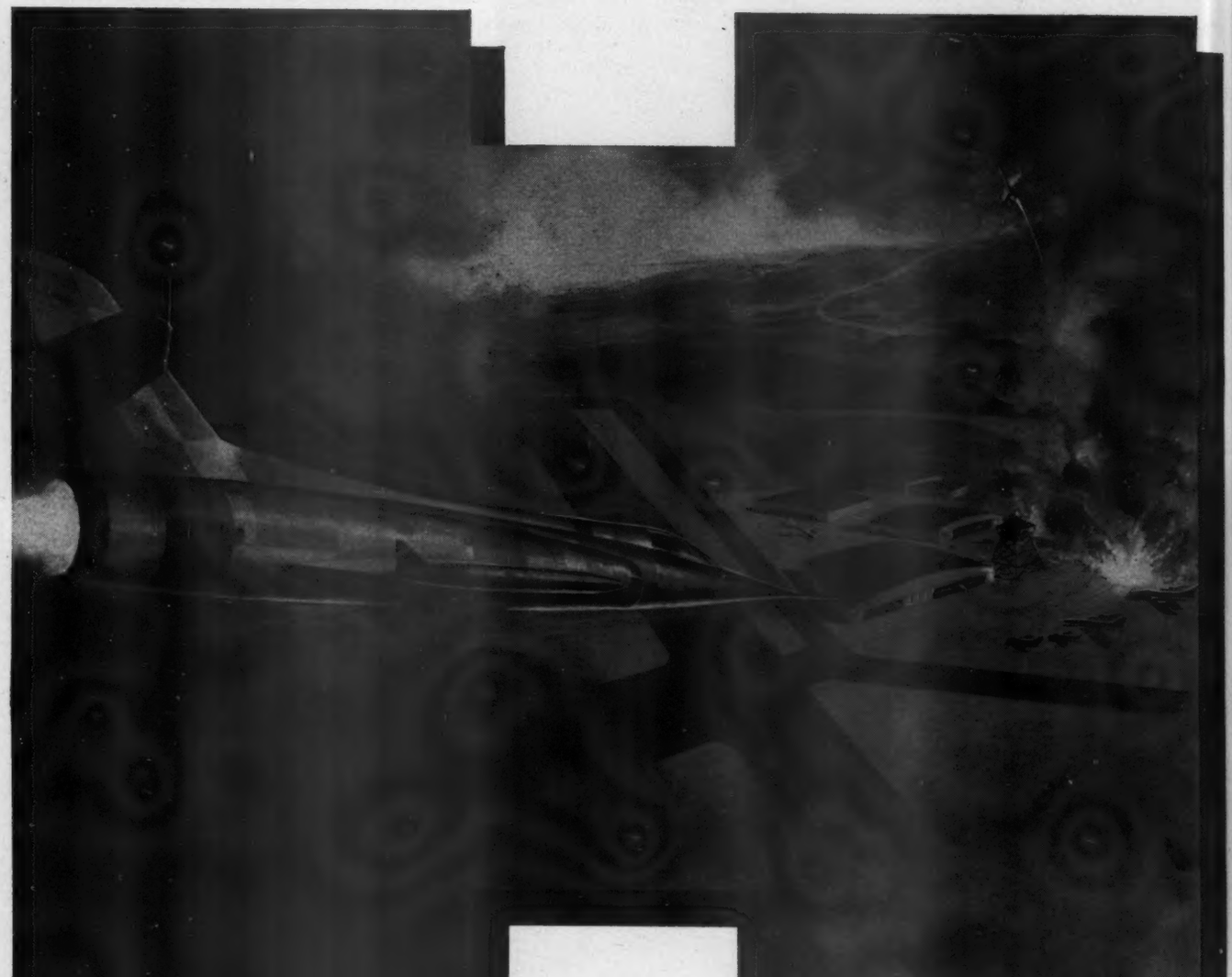

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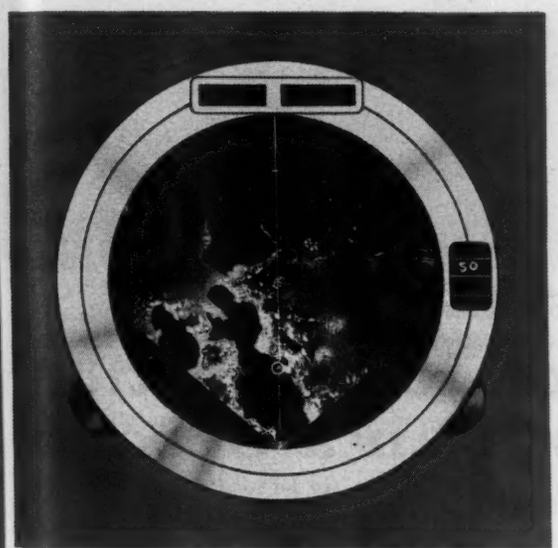

The display above furnishes radar information as a navigational check against the moving map display (right). In this way, it is possible to navigate directly to target in all kinds of weather!

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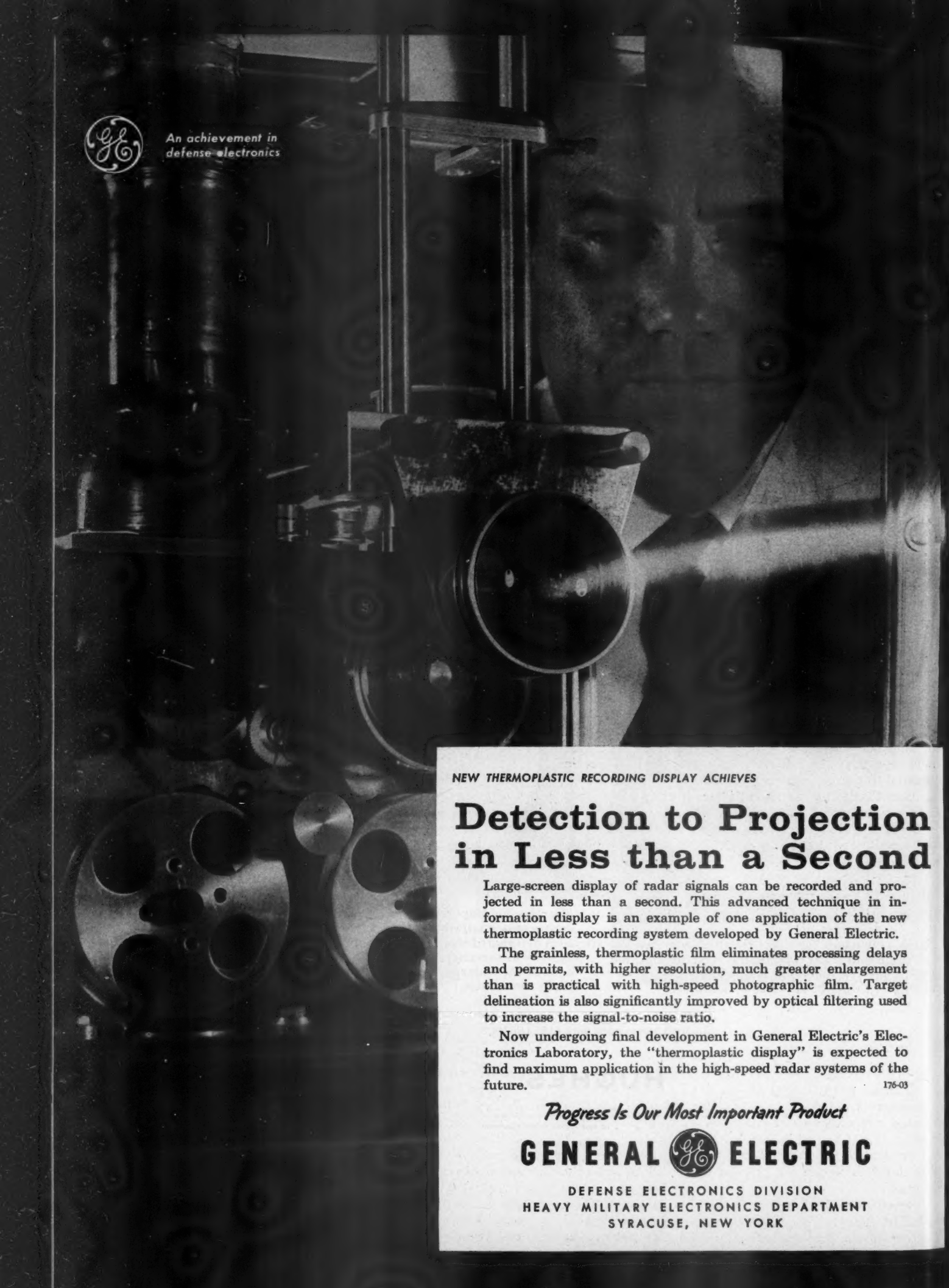

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Large-screen display of radar signals can be recorded and projected in less than a second. This advanced technique in information display is an example of one application of the new thermoplastic recording system developed by General Electric.

The grainless, thermoplastic film eliminates processing delays and permits, with higher resolution, much greater enlargement than is practical with high-speed photographic film. Target delineation is also significantly improved by optical filtering used to increase the signal-to-noise ratio.

Now undergoing final development in General Electric's Electronics Laboratory, the "thermoplastic display" is expected to find maximum application in the high-speed radar systems of the future. 176-03

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RESERVE AND AIR GUARD NEWS

AFA Policy on Reserve Plan

The **Air Force Association,** in an official policy statement approved by its **Board of Directors** late in March, has **endorsed major features of USAF's recently promulgated reserve forces concept,** because it puts the reserves in "greater alignment" with Air Force **wartime requirements.**

But AFA expressed the opinion that the projected reserve program can be truly effective only if a **stronger administrative structure,** with more centralized control, is **established at Pentagon level.**

AFA asserted in its statement that the **Assistant Chief of Staff for Reserve Forces** should be a **permanent, full-time member of the Air Force Council,** with rank appropriate to that position.

While the Association was pleased to note that studies are under way for **more effective utilization of reservists** in the individual reserve training program, it **withheld evaluation and comment** in this area "until more is learned of Air Force plans."

AFA declared the plan to assign **Air National Guard** units to gaining commands for **training and inspection** is "highly commendable, especially in view of their direct combat tie to these commands."

The announced action to assign **AFR troop carrier units** to a gaining command for **supervision of training and inspection** "normally would merit similar commendation and support," it was said. However, the policy statement noted, the **potential role** of these units in **post-attack recovery operations** has not yet been made clear.

"The **urgency for more defined** post-attack recovery roles and missions has been emphasized by congressional, government, and military leaders," the statement said. "Believing that the post-attack recovery mission is **indispensable to our deterrent posture,**" AFA declared it "assumes that a substantial requirement exists for **military airlift support** of this mission.

"Further, it would appear that a substantial part of the Air Force Reserve **troop carrier capability** could be utilized in providing the airlift required," AFA continued. "In this regard, it is noted that the new air reserve forces concept embraces the idea of assigning **other post-attack recovery missions** to the individual training element of the air reserve forces program."

AFA concluded that, because of such considerations, it is **"premature"** to permanently assign AFR troop carrier units to any command for supervision of training and inspection "before post-attack recovery roles and missions have been **clearly defined and established."**

At Second Glance

As AFA's policy statement notes, USAF is finding it more **difficult to reach firm conclusions** on the composition or functions of post-attack recovery units than it apparently expected when the new AFR mission was first proposed in January.

It is now considered **unlikely** that manning tables or other detailed description of such units will be released this year.

However, **Maj. Gen. Robert E. L. Eaton,** Assistant Chief of Staff for Reserve Forces, hopes to have an organizational directive on the management plan **ready for publication** this month.

The directive is expected to spell out the **organization and functions** of the **six new AFR divisions** that will **replace CONAC's numbered air forces** this fall. It may also designate the **headquarters** of each of the six divisions whose boundaries will be the **same as those of the six Army areas.**

It had **previously been announced** that Reserve troop carrier wings would be assigned for supervision of training and inspection, to **Tactical Air Command** by June 1. However, this would have required a transfer of these units during **summer field training season.** It would also have affected AFR plans for **Exercise Bright Star/Pine Cone III** in August, in which all fifteen AFR wings will participate. Accordingly, the date for such assignment has been set back **to September 1.**

'Completely Responsive'

Recommendations to **expand the air reserve forces** airlift capability and to **drop the Civil Reserve Air Fleet** (CRAF) from MATS mobilization plans have been unanimously adopted by AFA's Board of Directors.

The recommendations were contained in a detailed study on **"Military Airlift and the Reserve Forces of the Air Force,"** prepared by a committee of the AFA Air National Guard Council composed of **Col. Roy Cooper** of Wyoming, **Lt. Col. Phil Knight** of Minnesota, and **Lt. Dale Hendry** of Idaho.

The study had previously been presented to the joint meeting of **AFA's Air Guard and Air Reserve Councils.**

The committee led off with a statement that the **six C-97 squadrons** now in the Air Guard represent "a mere beginning" in fulfilling the nation's airlift need.

It called upon the Air Force to **convert additional KC-97s to cargo configurations,** for use by the air reserve forces, and to assign some KC-97s to the air reserve forces to serve Air National Guard units that require **midair refueling training** to become fully proficient.

It suggested that the Civil Reserve Air Fleet be turned over to the **Office of Civil and Defense Mobilization** where it could be used to fill urgent noncombat airlift requirements.

The soundness of these recommendations was underscored recently by **Lt. Gen. William H. Tunner,** MATS Commander, in a statement before the House Armed Services Subcommittee on Military Airlift, which is headed by **Congressman Mendel Rivers** of South Carolina.

Asked whether he would prefer **augmentation of MATS** by commercial carriers **or** by ANG, General Tunner said:

"I am interested in having people who are **completely and absolutely responsive** to me, will do what they are told, when they are told, how they are told—people who are trained to respond **under combat conditions.** So, obviously, I would prefer this gap to be filled by **military aircraft."** *(See also page 47, this issue.)*

The Cooper committee also recommended that AFA continue to afford "all possible assistance in attempting to resolve the **differences between the Air Transport Association and the Military Air Transport Service."**

And, "believing a possible requirement exists for **airlift support in a post-attack and domestic emergency relief role,**" the group recommended that AFA do a "thorough and definitive" study on that requirement.

(Continued on following page)

New Charter for AFCRF

Maj. Gen. R. M. Montgomery, Assistant Vice Chief of Staff, signed a memorandum on March 29 which designates the office of **Assistant Chief of Staff for Reserve Forces** as "the Air Staff office of primary interest for matters pertaining to the Air National Guard of the United States and the Air Force Reserve."

Before the Montgomery memorandum spelled it out, AFCRF's function had been variously interpreted as **monitoring, supervising, or coordinating** reserve forces actions at Headquarters USAF.

"It will be the responsibility of your office to ensure that Air Force policies and programs for the above components are **effectively implemented,**" the memorandum said.

"In addition, your office will be the **Air Staff point of contact** with the National Guard Bureau and the Continental Air Command for the respective components of the reserve forces."

A comprehensive report including a chart of General Eaton's new structure and the new CONAC structure for administering the reserve forces is planned for the July issue of AIR FORCE.

Reserves in Civil Defense?

Gen. Curtis E. LeMay, USAF Vice Chief of Staff, says he is convinced that **active and reserve forces,** rather than civil defense volunteers, will **take over civilian recovery tasks** if the US is attacked.

He told a congressional subcommittee looking into civil defense that "in case war should come, I would visualize **the civil defense agency going out of business** and the **military forces taking over.**"

He said he believed "most citizens of the country are certainly **relying on the military** for some help in cases like this because they certainly call on us first in case of just a mild disaster such as a flood. . . . I think the reserves could make a **very substantial contribution** in the civil defense field."

Elsewhere in his testimony, General LeMay reiterated his oft-expressed view that reserve forces **cannot be expected to handle modern weapon systems** and instead should be assigned **combat support roles.**

"As I see it, the trend [in employment of reserve forces] is going to be away from direct combat participation because of the **expensive and complicated weapon systems** coming into the program now," General LeMay said.

Systems like the Atlas and Titan, he asserted, are "so costly and complicated that we just **cannot stand the inefficiency** of putting part-time people on them. We are having troubles keeping up the training of people we have seven days a week.

"I see the trend of the Reserve and the National Guard away from such weapon systems and more into the **support area,** which is just as vital. They will be playing on the defense team, the same as anyone else, but they will be making their participation in other ways," he said.

More ANG Century Series Fighters

Four Air Guard squadrons in southern states will convert soon to the **Convair F-102 Delta Dagger,** says **Maj. Gen. Winston P. Wilson,** Deputy Chief of the National Guard Bureau. These are the first of a series of conversions which are expected to equip **eighteen ANG squadrons** with Century series fighters by next summer.

Squadrons at **Jacksonville, Fla., New Orleans, La.,** and **Houston** and **San Antonio, Tex.,** will turn in F-86Ds and 'Ls for the supersonic F-102s.

Four more squadrons, including the **199th in Hawaii,** are destined for F-102s early next year.

Another four squadrons will acquire **North American F-100s,** to make a total of seven flying the Super Sabre. Already equipped with F-100s are units at **Tucson,** Ariz., **Windsor Locks,** Conn., and **Washington,** D. C.

Units to receive new equipment, other than the first five to get 102s, **have not been announced.**

Pine Cone III

All fifteen wings of the **Air Force Reserve** will be "mobilized" in the latter **half of August,** along with **7,000 Air Guardsmen,** when the air reserve forces join with the Army's **101st Airborne Division in Exercise Bright Star/Pine Cone III.**

This will be the **biggest peacetime exercise** yet involving the air reserve forces, far outstripping last year's participation by Reservists and Guardsmen in **Dark Cloud/Pine Cone II.**

Brig. Gen. Rollin B. Moore, Commander of the 349th Troop Carrier Wing, Hamilton AFB, Calif., will be in charge of all Reserve units. **Brig. Gen. Don Strait,** 108th Tactical Fighter Wing Commander at McGuire AFB, N. J., will lead ANG forces.

The **Air Reserve** will operate **500 C-119s** and **thirty C-123s** in the fifteen wings, plus six aerial port squadrons, an aeromedical evacuation group, two casualty staging squadrons, and an AACS squadron.

The **Air Guard** will employ the 108th Tactical Fighter Wing, the 117th Tactical Reconnaissance Wing, and two SA-16 troop carrier squadrons. **TAC** will contribute a **force of F-105s** under General Strait's operational control.

A **communications net** to link all Pine Cone III bases, and **tactical control** for fighters and troop carriers, will be provided by ANG's 251st Communications Group and the 157th Tactical Control Group.

Plans call for **MATS to airlift the 101st Airborne** into half a dozen or more bases stretching from **Sewart AFB,** near Nashville, Tenn., to **Charleston AFB,** S. C., and **Langley AFB,** Va. There Reserve troop carriers will pick them up and deliver them into the drop zone.

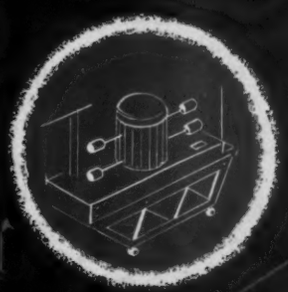
Air Guard units will be even more widely dispersed, operating throughout an area from **McGuire AFB** and **Atlantic City,** N. J., to **Gulfport,** Miss., where the 117th Recon Wing will be based.

D-day for the exercise is scheduled for **August 22,** when all of the 500-plus troop carrier aircraft will air-drop **Army paratroopers** under cover of the Guard's tactical fighters.

Generals Moore and Strait were to set up their planning staffs at **Fort Bragg and Seymour Johnson AFB,** N. C., respectively, on May 1.

• • •

NOTES FROM HERE AND THERE. . . . USAF construction authorized for the air reserve forces in **FY '61** totals **$11.8 million**—$7.2 million for **ANG,** $4.6 million for **AFR.** Biggest projects: $2.7 million for the Air Guard at **Jackson, Miss.,** for operations, maintenance, and supply facilities; $2 million for AFR at **Dallas, Tex.,** Naval Air Station for maintenance and supply buildings. . . . **ANG's 135th Troop Carrier Squadron** has moved from Harbor Field, Baltimore, to the **Glenn L. Martin airport.** . . . **Col. Charles F. Bock,** former Commander Newark ARC, is now in DCS/Personnel, Hq. USAF.—END



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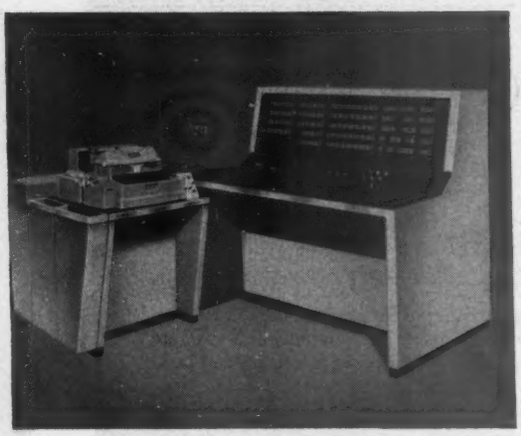
The Univac Scientific computer is used to simulate and prove the projected design of new systems. This concept of mechanized design, which may be described as the use of one computer to build another, eliminates prototype building and attains a degree of reliability once regarded as only theoretically possible.

A technician follows the wiring diagram produced by the Univac Scientific. This application of mechanized design greatly facilitates the production of reliable automatic data processing equipment.



A significant achievement of mechanized design is the BOGART computer, produced by Remington Rand Univac, for the U.S. Navy. Intensive preliminary testing of the projected system made it possible to reduce the size of the computer while materially increasing its reliability through the use of transistors and printed circuitry.

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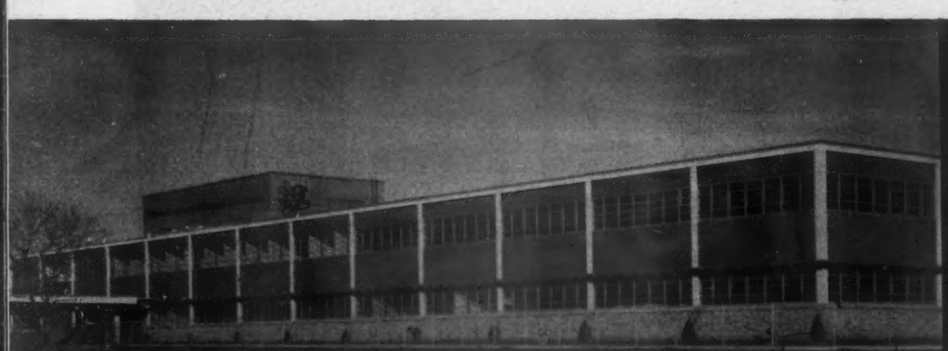

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AFA NEWS

SQUADRON OF THE MONTH

Squadrons of the Utah Wing, Cited for

outstanding programming in achieving a successful blending of the airman and the educator during its 1960 Intermountain Conference on Aerospace Education.

Utah Wing's Intermountain Conference on Aerospace Education, the 1960 edition of its annual airpower symposium, turned out to be one of the **most impressive programs** held in AFA in years.

The conference was built around outdoor and indoor **exhibits of aerospace hardware** and a series of defense briefings for the 400 teachers who attended from throughout the state. A Douglas **Thor IRBM,** a Northrop **Snark** intercontinental cruise missile, a Boeing **Bomarc** air defense missile, and other missiles were on display outdoors (*see cut at right*). The indoor exhibit included a model of the **Project Mercury man-in-space capsule** designed by McDonnell Aircraft Corp., and many other items.

The teachers present were divided into ten groups of forty, each group receiving ten separate briefings on different **areas of national defense by industrial concerns located in Utah.**

Main speaker at the kickoff dinner of the conference was **James H. Straubel,** AFA's Executive Director. Former AFA President and current National Director **Gill Robb Wilson** spoke at a windup luncheon. The state's top education authorities cooperated in staging the conference and bringing together the participants.

Robert P. Stewart, principal of Lakeview School in Roy, Utah, the recently elected Commander of the Ogden Squadron, was General Chairman of the conference. His principal assistants were **Bill Farmer,** Utah Wing Commander, and **Karl Caldwell,** Vice Commander.

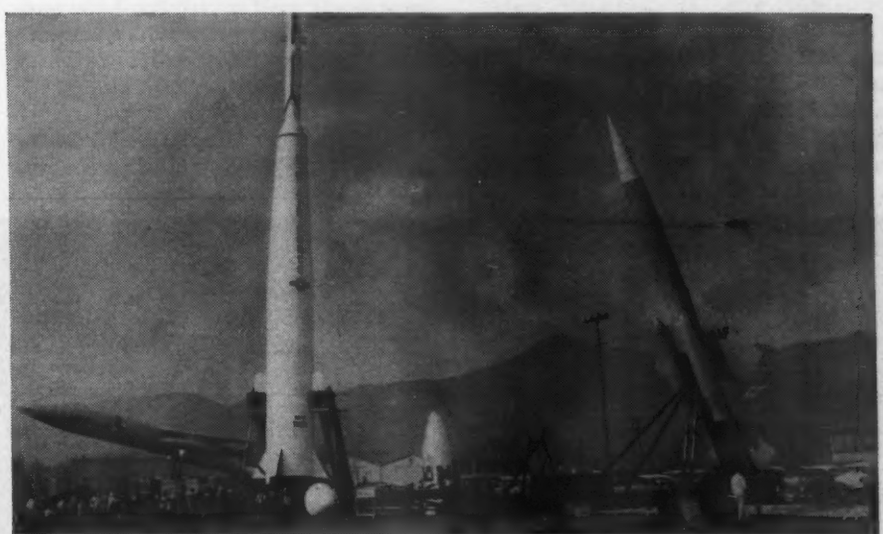
Industries participating included **Hercules Powder Co., Marquardt Corp., Northrop Corp., Boeing Airplane Co., Thiokol Chemical Co., Litton Industries, International Business Machines, McDonnell Aircraft,** and **United Air Lines.** Strong support for the entire program was given by **Maj. Gen. Kenneth Hobson,** USAF, Commander, Ogden Air Materiel Area, and members of his command.

The aerospace age, and its implications for education, is a subject that will no doubt be programmed more and more in AFA units in the future. The Utah Wing and its individual leaders are to be commended for taking leadership in this area.

Locale of the conference was the campus of the **University of Utah.**

In all, it was a truly topflight program on a topic of growing importance—and seems to indicate that the Utah Wing is again after the **President's Trophy,** which it won in 1956.

(Continued on following page)



The University of Utah campus took on the appearance of a launch pad during the Utah Symposium *(see text for details).* Hundreds walked through the Thor-Able, saw the Snark (left) intercontinental cruise missile, and Bomarc (right).

Season's worst weather didn't keep AFA President Howard Markey from Birmingham Squadron installation. Seated with him is George R. Doster, Alabama Wing Commander. Standing from left: Squadron Commanders John Comish, Mobile; Oliver Wiley, Montgomery; Dr. Edwin Speed, Birmingham.

Participants in the Utah Symposium included (seated) James H. Straubel, AFA Executive Director; William J. Farmer, Utah Wing Commander; Gill Robb Wilson, AFA Director. Standing, from left, Robert P. Stewart, General Chairman for the Symposium, and Karl Caldwell, Utah Wing Vice Cmdr.

Union-Morris, N. J., Squadron award went last month to Lt. Col. Francis Johnson (second from right), Cmdr., 9255th Air Reserve Sqdn. Also at banquet are Capt. Arthur Denning, N. J. CAP; Frank DeFillipis, Sqdn. Cmdr.; Lloyd Nelson, N. J. Wing Cmdr.; and Rev. William Laird, AFA Chaplain. Brig. Gen. Donald Strait was the main speaker.

Among those at Wright Anniversary program sponsored by Passaic-Bergen, N. J., Squadron are, from left, Lloyd Marsh, Fred Wehran, Ronald Gall, Edward R. Hill of Curtiss-Wright Corp., T. B. McGuire, father of World War II ace for whom McGuire AFB is named, Frank Graves, Squadron Cmdr. Nathan Lane, Lloyd Nelson, and State Senator Anthony Grossi.

The **Claire Chennault Squadron** of Oak Park, Mich., recently procured a surplus **F-84 jet** for permanent display outside the **Jewish Community Center** of that city. It was a major project, one that required cooperation from many directions, and also a rewarding one.

The Jewish center requested Squadron assistance in this endeavor back in 1957. The Squadron enlisted the aid of the **Air Materiel Command, the Wayne County, Mich., Road Commission,** and the **127th Tactical Recon Squadron** of the **Michigan Air National Guard** in ultimately bringing the plane to Oak Park. The ANG outfit dissassembled the plane, transported it some forty miles to Oak Park, and then reassembled it there.

Squadron Vice Commander **Norman Scott** was in charge of the program, for which we congratulate him and other members who took part in this project.

• • •

Miss Joanne Alford, well remembered by AFAers across the country for her lecture series to high school students following the 1956 National Convention, where she was **"Miss Airpower,"** is now applying her engineering talents in the **Human Factors Research Division of Convair** in San Diego. It appears that, though Joanne has changed employment (she worked for the **Martin Co.** until last year), she hasn't altered her interest in speaking to the public. Last month, as a new member of the **San Diego Squadron,** she spoke before the group on **"Women in Space."**

WHERE THE WORLD OF TOMORROW IS NOW

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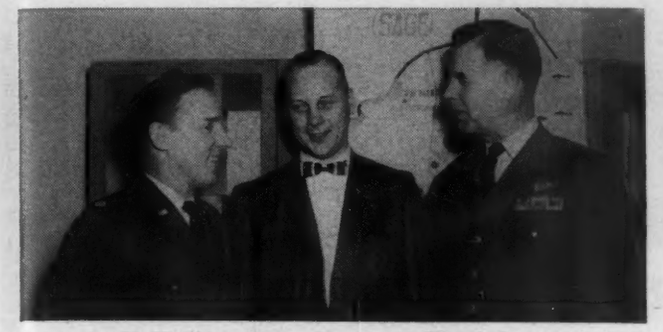

Syracuse, N. Y., Squadron program in March featured three active commanders: Lt. Col. Jerome Schweickert, Cmdr., Hancock AFB; Gordon Thiel, AFA Squadron Cmdr.; and Col. John Cornett, Cmdr., Syracuse Air Defense Sector, ADC. The unit has announced an ambitious schedule of programs to carry it through the entire year under Thiel's direction.

AFAers and city leaders of Chico, Calif., are shown during Chico Squadron tour of NORAD, ADC, and the Air Force Academy. Trip was planned for two days, but engine trouble on return necessitated overnight stop at Cheyenne. Squadron Cmdr. Tom Mason, second from left in photo, was in charge of the orientation tour, which took place on March 13.

Cross Country . . . Board action on March 26 determined the need for selecting **National Convention sites farther in advance** than previously in order to secure necessary accommodations. Accordingly, the Board chose sites through 1963: **Chicago for 1961, Las Vegas for 1962, Philadelphia for 1963** . . . The **Pennsylvania Wing Convention** is slated for **May 21** in **Lewistown,** with **Prestie Headings** as Chairman. President **Howard Markey** will speak . . . Primarily due to the efforts of **Art Storz,** an expansion program for the **Omaha Airport** has been approved. Largest single factor was a $1 million grant from the **Eppley Foundation** which will be matched with federal funds. This climaxes a long fight by air-minded citizens of Omaha . . . **Robert G. Brown,** engineer with **AC Spark Plug Division of General Motors,** was selected by the **Milwaukee Squadron** as winner of its 1960 **Billy Mitchell Award. Gary Ortmann,** Squadron Commander, presented the trophy at the annual banquet held January 23 . . . **Col. Dean E. Hess,** Chief of Los Angeles Office of USAF Information, was principal speaker at the installation banquet of the **1st Reserve (Long Beach) Squadron** March 26. **John Bainer,** one of the founders of the Squadron, was elected Commander . . . **Front Range, Colo., Squadron** has a unique program. Whenever a **"Welcome Wagon"** hostess finds that a **new arrival has an Air Force background,** she provides a free copy of AIR FORCE/SPACE DIGEST and an invitation **from the Squadron** to participate. —GUS DUDA

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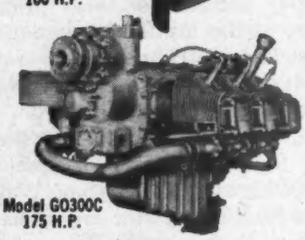

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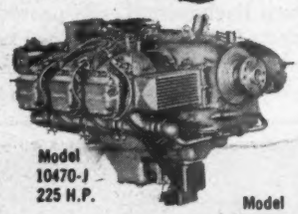

Model
10470-J
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Model
FSO526-A
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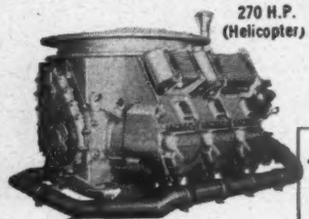
(Helicopter)



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The Great Debate

***Massive Retaliation: The Policy and Its Critics*, by Paul Peeters (Henry Regnery Co., 1959, $5)**

Reviewed by Maj. Abbott C. Greenleaf

Massive Retaliation complements Bernard Brodie's *Strategy in the Missile Age* and Oskar Morgenstern's *The Question of National Defense.*

Brodie analyzes the fundamentals of modern strategies. Morgenstern questions the composition and adequacy of our existing military posture.

Peeters' newly published *Massive Retaliation* analyzes the international and military record of the Eisenhower Administration largely in terms of public understanding. It presents a stout defense of Administration policies.

This is a worthwhile book. But it would have been a better one under a different title.

Much of the author's effort is addressed to the problem of the "slow erosion of moral certitudes in the ranks of the liberal American intelligentsia," and to alleged political irresponsibility among partisan opponents of the Eisenhower Administration. In these investigations, discussion of the massive retaliation debate seems but a means, or vehicle, to Mr. Peeters' broader objective. He is both a pragmatist and a believer in *Realpolitik* as the basis for the formulation and execution of national policy; this position he sets forth with diligence.

To Mr. Peeters, the concept of massive retaliation has five general meanings, each of which has been developed by spokesmen of the Administration:

- It means a capacity to inflict "punishing damage."
- It is "massive" to the extent that it could go beyond a conflict's original limitations.
- It could alter the fundamental nature of a conflict by bringing a war to the actual instigator of an aggression.
- Massive retaliation as our national policy states that if the Soviet Union should attack the United States or its vital interests, or reveal an intention to do so, the USSR would "immediately be attacked by air and sea with all sorts of nuclear weapons."
- The doctrine rests upon the ability of the United States to maintain a capacity for its delivery.

Discussion of deterrent strategy, however, is scattered among many pages of commentary on US foreign policy. Mr. Peeters presents an excellent analysis of the policies this nation has followed since World War II.

He does not devote the same effort to a critical analysis of our deterrent posture. His many skillful observations on the American political process, the characteristics of public opinion in the United States, American liberalism, the problems of the Presidency, and so on, could have been written almost without reference to the doctrine of massive retaliation.

One section of the book, "The Massive Retaliation Debate," investigates several of the major arguments which have been used against massive retaliation, dismisses their validity, but, nonetheless, recognizes their general acceptance. Continued support of these views could lead "into the dead end that results from the willful annihilation of the policy it criticizes," Mr. Peeters writes.

Mr. Peeters strongly supports massive retaliation as a national policy. He sees no alternative that can satisfy the variety of security imperatives facing the US. Yet, he is apparently convinced that in light of rather universal public misunderstanding of the concept, political partisans may well destroy it!

About the reviewer: *Major Greenleaf is a member of the Long-Range Objectives Group, Directorate of Plans, Hq. USAF.*

Official Aerospace Publications

Two recent desk references are drawing wide interest among writers, editors, and researchers:

A Chronology of American Aerospace Events, Air Force pamphlet 210-1-1, July 1, 1959, prepared by the Office of Information, USAF, is a revised updating that lists all significant American aviation events (with emphasis on USAF) and other datefacts that mark our nation's air progress. Events are listed chronologically from 1903 to the present by year and by day.

Interim Aerospace Terminology Reference, Air Force Pamphlet 11-1-4, October 30, 1959, prepared by the Terminology Branch, Hq. USAF, is an interim consolidation of aerospace terms and definitions that have appeared in various AF publications

(Continued on following page)

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Here is a balanced, objective analysis of the fundamental military problems presented by modern warfare . . . a book to stimulate thought, conversation, and action. No one who is concerned with airpower and its place in military strategy in the years ahead can afford to miss this important new book. Bookstore price $6.50.

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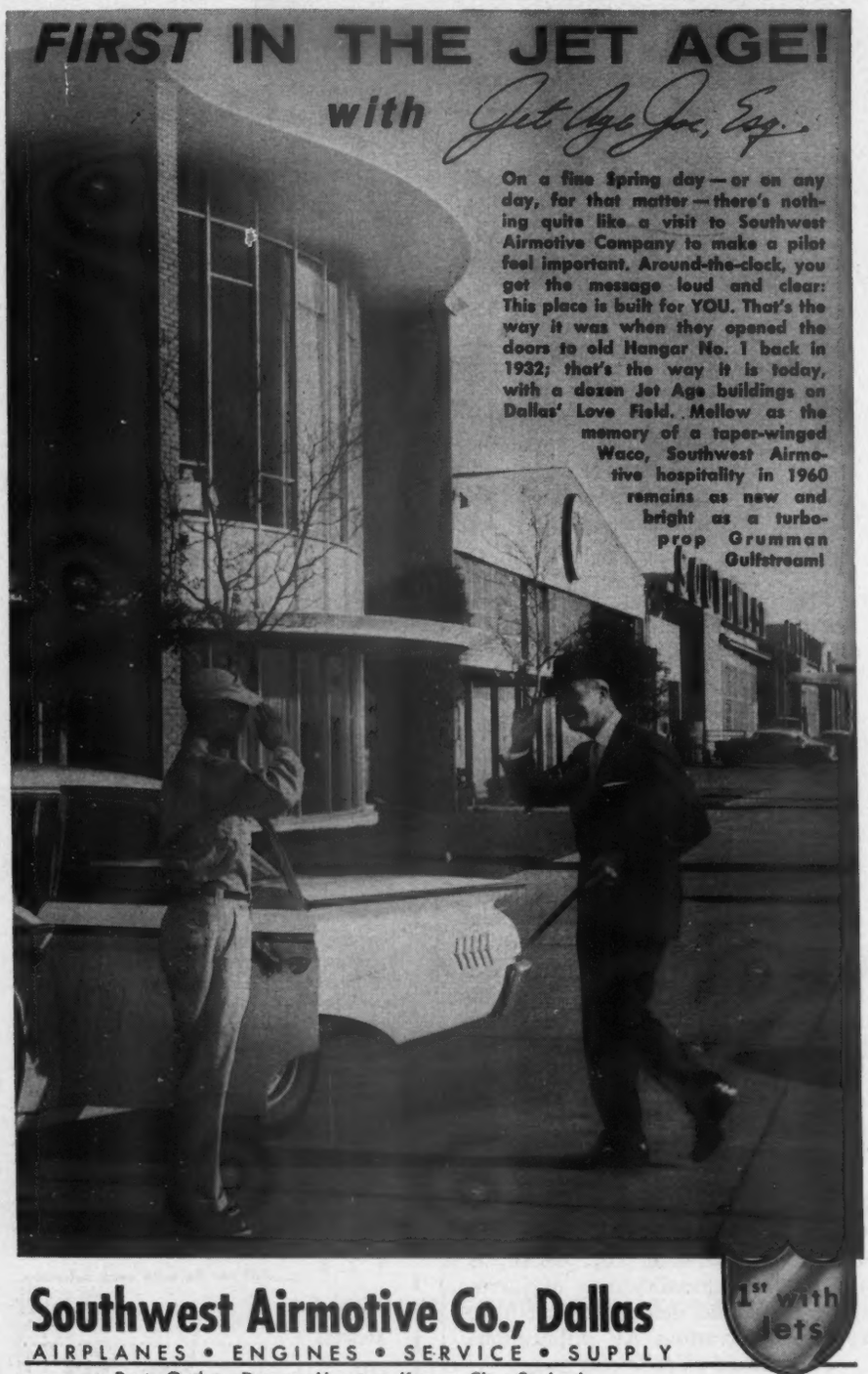
and official staff papers. It will be replaced soon by an *Air Force Glossary of Aerospace Terminology,* which will represent the final standardization of official terminology.

The USAF Historical Division announces publication of two studies dealing with the German Luftwaffe of World War II. Both belong to a series of thirty-nine proposed historical projects written by, or based on information supplied by, former key officers of the German Air Force:

The German Air Force General Staff, by General-leutnant Andreas Nielsen (Research Studies Institute, Air Univ., Historical Study No. 173)—A comprehensive analysis and history of Germany's wartime Air Force High Command.

Historical Turning Points in the German Air Force War Effort, by Richard Suchenwirth (Research Studies Institute, Air Univ., Historical Study No. 189)—A study of the Luftwaffe's defeat and the major causes or "turning points."

The objectives of this ambitious historical project are to provide the Air Force a definitive history of the defeat of a major air force in war, to tell that history through the principal and responsible air leaders, and to obtain first-hand information on air combat with the Soviet Union. The over-all project will transcribe the history of the German military air effort from the Treaty of Versailles after World War I through to Germany's final defeat in 1945.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Aerospace Books in Brief

The Complete Book of Jets and Rockets, by D. N. Ahnstrom (World, $4.95)—A revised, updated edition.

Out of This World, as Told to Minerva the Cat, by Dr. Dan Q. Posin (Popular Mechanics Press, $3.95)—Book version of the unique CBS-TV show by the same name, explaining in narrative and humorous line drawing the basics of space travel, astronomy, and allied physical sciences. The author is professor of physics at DePaul University, Chicago.

Taranto, by Don C. Newton and Cecil Hampshire (William Kimber, London, $3.95)—The story of the successful British carrier air strike on the Italian fleet in Taranto Harbor, Italy, November 11, 1940.

Flattop: The Action-Packed Story of US Aircraft Carriers, Past and Present, by Barrett Gallagher (Doubleday, $5.95)—Text by six top US Navy admirals; illustrated.

Year, The Picture News Annual (Year, Inc., $7.95)—The outstanding events of 1959 in 1,000 pictures and 75,000 words, a large portion of which is devoted to military-civilian aviation, rockets, missiles, and space exploration.

Jane's All The World's Aircraft, 1959-1960 (McGraw-Hill, $30).

The Aeroplane Pictorial Review (No. 4) (Temple Press, London)—Compiled by the Staff of *The Aeroplane and Astronautics.*

Related Reading

Top picture history of World War II to date is *The Second World War* by Sir Winston Churchill and the editors of *Life* magazine (Houghton, Mifflin, 2 vols., $27.50 boxed with an LP disc of twelve Churchill speeches; 2 vols. unboxed, $25).

The narrative is an abridgement of Churchill's classic six-volume history of World War II. Complementing it is a magnificent array of the best combat photographs by *Life* and other

(Continued on page 99)

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View of the city of San Juan, Puerto Rico

NEW UNDERSEA TELEPHONE CABLE TO PUERTO RICO AIDS DEFENSE

In addition to its social and business usefulness, the new submarine telephone cable opened recently to Puerto Rico benefits the nation's defense efforts as well.

For it provides a dependable communications link for military and civilian use between the mainland and an important territory.

This new cable is the deepest telephone cable in the world, at one point dropping to a depth of five miles below the ocean's surface. The cable project was undertaken jointly by the Long Lines Department of American Telephone and Telegraph Company and the Radio Corporation of Puerto Rico, a subsidiary of International Telephone & Telegraph Corp.

The Puerto Rican telephone cable joins many others laid in the past few years—to Hawaii, Alaska, England and Europe—and provides another element of the world-wide communications network we are helping to develop for both civilian and military use.

BELL TELEPHONE SYSTEM

photo correspondents, and numerous paintings of the war period in monochrome and color. Illustrations and schematic maps throughout contribute to an eye-appealing and absorbing account.

• • •

The C. S. Hammond Company's new eighteen-inch-diameter inflatable vinylite world globe, printed in nine pastel colors, would be a useful and decorative addition to any home, office, or school library. The plastic globe comes with metal stand for desk, table, or wall mounting. Nearly five feet around at the equator, it is comparable to a fifty-six-inch wall map, with geographic and topographic details in clear and readable style.

This unique map is inflated through a metal valve like a beachball. It twirls easily on its stand. And it can be deflated into a small package for shipping. The nonilluminated globe sells for $16.95, the illuminated model for $19.95. With its easy-to-move compactness and its comprehensive worldwide coverage of countries, cities, and terrain features, this new globe would seem tailor-made for military families.

• • •

The West Point Atlas of American Wars, edited by Col. Vincent J. Esposito, USA, 2 vols. (Praeger, $47.50), traces in detailed map and accompanying text every important battle from the American Revolution through the Korean War. It features more than 400 battle maps in three and four colors, compiled from official military records, and based upon teaching materials used in military history courses at the military academy. A monumental work in its area, this atlas is of interest and use to the professional military man, the teacher and student in university-level military history courses.

• • •

Sen. Paul H. Douglas (D.-Ill.) introduces *The United States Marines: A Pictorial History*, by Lynn Montrose (Rinehart, $10). Similar in layout and coverage to Rinehart's *Air Force: A Pictorial History of American Air Power*, this photo-text contains 434 illustrations (mainly combat shots) and covers the history of the Marine Corps from founding to the present.

• • •

In *Civilians Under Arms* (Pennington Press, $4.50), Herbert Mitgang has gathered an anthology of stories, articles, and poems about the American soldier from the Civil War through Korea. Organized by wars (both Confederate and Union selections appear for the Civil War), this volume shows how the serviceman lived, thought, fought, and died throughout the past century.

• • •

Hilary H. Milton, a civilian employee in the Office of the Secretary of the Air Staff, Hq. USAF, has been writing speeches, briefings, official manuals, and regulations for more than ten years. Now he has privately published a manual and guide, *Steps to Better Writing* (Professional Press, College Park, Md., $2.75), based on his experiences.

—MAJ. JAMES F. SUNDERMAN, USAF

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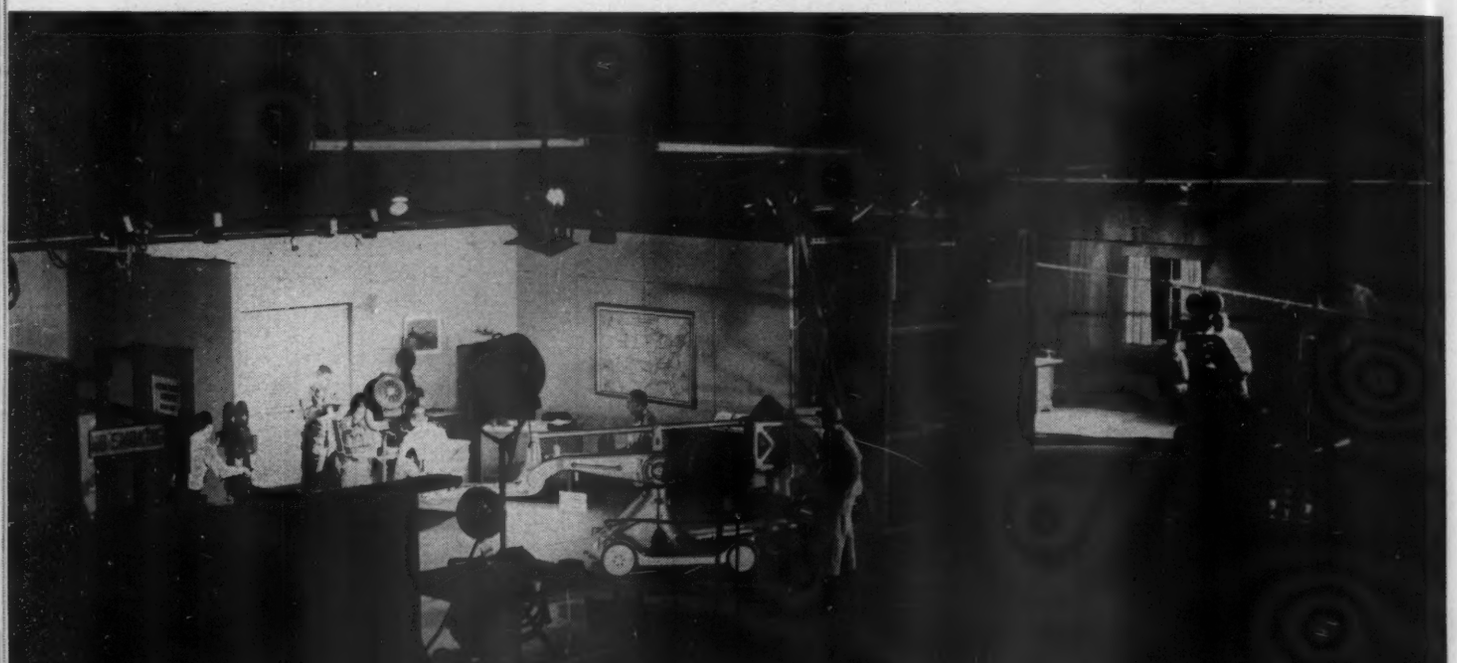
HOLLYWOOD WITHOUT THE

Lt. Col. Carroll V. Glines, USAF



Months of preparation and minutes of noisy activity past, cameras simultaneously record two scenes in Air Force film production. Grouping of scenes and sequence of shooting are important factors on the financial side of service movie-making, which is carried out by the 1365th Photographic Group of USAF's Air Photographic and Charting Service.

QUIET on the set!"
"Roll 'em!"
"Speed!"
"Action!"

The reels are in motion on another moving picture—but one significantly different from most Hollywood productions. The producer, in this case, is the United States Air Force.

Almost from his first day in the service, the recruit sees Air Force films. Throughout his military career, he gains much of his total knowledge of his job, his responsibilities, and the mission of the Air Force via this medium.

The complex job of planning and writing most Air Force films is handled by a small group of experienced writers, animators, and technicians. They are the men of the 1365th Photographic Group, USAF Air Photographic and Charting Service (APCS), headed by Lt. Col. James P. Warndorf, USAF. Colonel Warndorf makes his headquarters at Orlando AFB, Fla. The Group is divided into three divisions: Projects, Art and Animation, and Scenario.

The Group turns out more than 400 reels a year for the Air Force. It is not an easy job. The subject matter varies from "Abdominal Colostomy Closure" to "The Zero Reader," and runs the gamut of security classifications from Unclassified, which can be shown to civilian audiences, to Top Secret, NOFORN (No Foreign Nationals), which can be shown only to American military personnel with the highest kind of need to know.

"We have many, many problems that the private producers never have to face," APCS's Maj. Peter Boyko says, "and yet we enjoy a freedom from the pressure of 'box-office draw' which gives Hollywood its biggest headaches. Our writers can work in comparative relaxation here in Orlando. Yet, we still have schedules to meet, and we must please the commanders who asked for the films in the first place. You might say it's Hollywood without the ulcers."

Major Boyko, an old hand at film production, until recently headed APCS's Commercial Projects Division.

While there may be a few similarities between the Air Force's "Hollywood" and the movie capital, these similarities do not include working conditions. The divisions of the Group occupy several one-story buildings on the base, all of

ULCERS

B-47 crew simulates alert for benefit of service camera crew at McCoy AFB, Fla. Photographic personnel belong to Orlando's "Hollywood" group. Actually, most footage in Air Force films is taken by private concerns that work under the supervision of APCS.

which were built during World War II. The writers of the Scenario Division, for example, are assigned a series of "cells" in an E-shaped building. In these cubicles, recently renovated, are born excellent motion pictures that vastly influence the quality of the widespread global Air Force.

The process of getting a training film made for the Air Force is uncomplicated but requires a good deal of work by a number of people.

Production of a film, from conception by a potential Air Force user to final preapproval screening in the Pentagon, takes about a year. The films average some thirty minutes each and are produced in both color and black-and-white.

"As soon as we get the requirement for a film we assign the project to one of our stable of twenty-eight writers," Major Boyko explains. "We call in the technical adviser, usually from the command that originated the request, to explain the technical aspects of the subject matter. The writer then translates the purpose of the film and the technical points into a screenplay, always remembering the type of audience for which the film is intended."

"The job is not always as simple as it sounds," says one script writer who is a prolific author of short stories in his off-duty time. "Sometimes the purpose of the film is not clear. Sometimes the technical adviser wants to keep things too technical for film purposes. Or sometimes we writers have a rough time finding a story line that we can build on."

"More often than not," he continues, "after many hours of discussion with the technical adviser, the writer can see several ways to portray the basic idea and we then choose the best one."

After a script is written and approved by the Group, it goes through a series of reviews. The command that requested the film reviews it to make sure it gets the point across. It is next reviewed by members of the Group staff, then APCS Headquarters, and finally by interested Pentagon staff offices. At any one of these reviews, someone may suggest a change or two or, in fact, flatly disapprove of the whole presentation.

When a script is finally approved, it is scheduled into production and Invitations for Bids (IFBs) are sent out by the Air Materiel Command. Motion picture companies look over the script, figure costs, gauge profit margins, and submit bids. About 200 bona fide producers are considered qualified to bid on Air Force films. The lowest bidder gets the contract. He is invited to a conference at Orlando, where the entire script is carefully reviewed by the Projects Division, the "buyers" from AMC, requesting-command representatives, and the private producer. At this time, also, the Air Force makes arrangements for the concern's crew to visit bases or missile sites necessary to film the story. A shooting schedule is then set.

The next step, if the film requires professional actors, is to call the technical adviser to the producer's studio to choose those who will play the parts listed in the script. At least three actors are sent from a casting agency for each part. This done, scripts are given to the ones chosen, and the shooting sequence is announced.

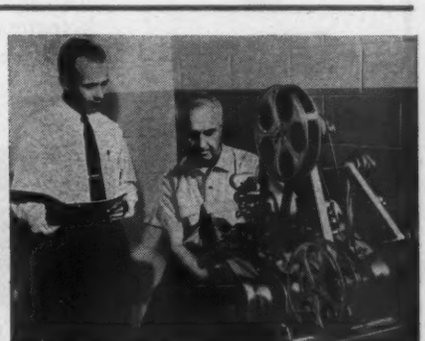
On the appointed day the producer's studio, which he may own himself or have leased from another firm, is alive with noisy activity. Sets have already been built, "grips" wrestle with props and dolly tracks, the director makes last-minute arrangements, and actors stand by mumbling their lines to themselves —just as on any movie set anywhere.

Then, a few familiar commands from the director . . . cameras begin to turn . . . actors move through

(Continued on following page)

In Maj. Gen. Bernard Schriever's office, when he headed BMD, a civilian director, right, discusses new film with Louis Dunn, STL; APCS project officer; Generals Ben Funk and Schriever.

Artist-animator at Orlando prepares art work to be used in portion of Air Force film on the subject of flying safety, an important part of service-wide drive in this regard.



Celluloid files. Here two civilian producers look through Air Force Film Archives, Wright-Patterson AFB, Ohio, for documentary shots to be used in movies which are now in the works.

their paces . . . and a film is on the way to "the can."

At the completion of each day's shooting, the exposed film is rushed off for processing, and the "rushes" are viewed as soon as possible to see how they turned out. Scenes unsatisfactory to the Air Force representatives are scheduled for reshooting immediately.

Shooting and rush viewing finished, the producer usually releases his crews and actors. They have probably been hired only for the specific purpose of producing that one film. Very few of the movie-making firms retain staffs on a full-time basis.

A few weeks after shooting, technical advisers and command representatives are called to Orlando to see the "rough cut" of the film. To a layman, this is sometimes a shocking experience because the film is in its rawest form. Although scenes are in proper sequence, there are no "opticals" (fades, dissolves, or superimposures) and no music.

If the rough-cut screening is satisfactory to all parties, the order is given to the producer to complete the film as called for in his contract. Not long afterward, a final screening is scheduled for the Pentagon where it is again reviewed by the technical adviser, his command representative, APCS experts, and officers of Headquarters USAF responsible for training films. Final approval here gives the Air Materiel Command the green light to make a contract with a film laboratory and run off the number of prints needed. In a few weeks, Air Force film libraries receive the prints for showing.

While the process for the average film is simple enough, an objection by anyone in authority can send the film back to the producer for refilming. This has occasionally happened.

One producer gives this opinion: "At first, it might appear that we would object to having the Air Force do part of our job for us, but it just isn't so. The scripts are well written, the technical advisers are well chosen, and we have no quarrel with the contracts. This makes our job easier. We don't have to keep a big stable of writers on our payroll just so we can bid on Air Force films. In short, we like the arrangement and wouldn't want it any other way."

So far as the Air Force as a whole is concerned, these training films meet an important requirement. And the "moving-picture magnates" of Orlando contribute directly, through the exercise of their considerable talents, to the defense of the nation.—END

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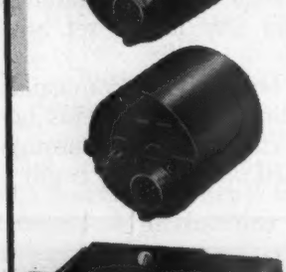

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The author, Lt. Col. Carroll V. Glines, now is Chief, Planning Team, Monitoring System Group, Directorate of Operational Requirements, Hq. USAF. He was formerly stationed at Hq. AMC, Wright-Patterson AFB, Ohio. Colonel Glines is also the coauthor of a new book on the DC-3, Grand Old Lady. His most recent article for us was "Have Show...Will Travel."

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AFA'S 1960 CONVENTION AND AEROSPACE PANORAMA

SAN FRANCISCO, CALIFORNIA • SEPTEMBER 21-25

THE PROGRAM

• WEDNESDAY, SEPTEMBER 21:

2:00 PM AFA Directors' Meeting
7:30 PM Reserve Forces Seminar

• THURSDAY, SEPTEMBER 22:

9:00 AM USAF Command Briefing
9:00 AM AFA Leaders' Meeting
1:00 AM USAF Command Briefing
2:30 PM Aerospace Luncheon
3:00 PM USAF Command Briefing
3:00 PM 1st AFA Business Session
5:00 PM USAF Command Briefing
7:00 PM Panorama Preview Reception

• FRIDAY, SEPTEMBER 23:

9:00 AM 2d AFA Business Session
9:00 AM Air Force Procurement Seminar
12:00 N Buffet Luncheon
12:00 N Panorama Open
2:00 PM USAF Command Briefing
3:00 PM 3d AFA Business Session
4:00 PM USAF Command Briefing
7:45 PM Awards Banquet

• SATURDAY, SEPTEMBER 24:

9:00 AM Annual Symposium
12:00 N Panorama Open
6:00 PM Nob Hill Reunion Party
9:30 PM Golden Gate Reunion Ball

• SUNDAY, SEPTEMBER 25:

12:00 N Panorama Open to Public

Listed to the left is the schedule for AFA's 1960 Convention in San Francisco, Calif., September 21-25. You will note that many improvements have been made over last year, leaving more time for everyone attending. There will be several USAF Command Briefings and a USAF Procurement Seminar for newsmen and industry; a seminar for Reservists and Guardsmen; business sessions for AFA leaders; and a symposium and several social functions for everyone. Also note that no major events are scheduled during Panorama open hours Friday and Saturday afternoons.

EVERYONE is requested to register IN ADVANCE for AFA's 1960 Convention and Panorama. Credentials will be required to attend the meetings and Panorama, and tickets will be required to attend the various social functions.

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☐ **BASIC REGISTRATION** ..... **$ 7.00**
(Includes credentials, meetings, Panorama Reception, but not tickets to any of the other Convention events)

SEE NEXT PAGE FOR HOTEL INFORMATION

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HOTEL	SINGLE	TWIN & DOUBLE	1-B/R SUITE	2-B/R SUITE
Alexander Hamilton	$9-14	$12-18	$20-35	$60
Bellevue	$11-12	$11-15	$25	
Californian	$9-11	$11-14	$22-25	
Canterbury	$10-19	$10-20	$25-40	
Clift	$13-21	$15-23	$41-50	
Drake Wiltshire	$10-11	$12-16	$25-35	
Huntington	$11-16	$14-25	$30-50	
Jack Tar	$10-16	$12-22	$43-45	$50-75
Richelieu	$7-8	$8-12	$20-25	
Sheraton-Palace	$8-16	$14-20	$25-50	$39-75
Stewart	$9-12	$9-18	$25-30	
Whitcomb	$10-12	$11-16	$25-60	$41-76
MOTEL				
Caravan	$18-22	$18-22		
Continental	$14	$14-16	$25-37	
Holiday	$20	$20	$30-50	
Mart	$7-9	$8-14	$16-24	
Travelodge	$8	$10-14		

Sold Out: Fairmont Hotel—Mark Hopkins Hotel—St. Francis Hotel—Sir Francis Drake Hotel

NOTE: A deposit of $10 per room is required for all arrivals after 5 p.m. All rooms will be assigned according to nearest available rate. Additional hotels and motels not listed above are available at slightly lower rates.

USAF ON FILM

Monthly Review of Selected USAF Film Releases

Here is this month's list of selected USAF film releases. These and others are available for loan from the Air Force Film Library Center, 8900 South Broadway, St. Louis 25, Mo., or base film libraries around the globe. Requests, which are welcome from both military and civilian groups, should contain Air Force serial numbers and correct titles to avoid delay in processing. Because of heavy demands for certain films, particularly those on missiles and space, the Film Library Center recommends that requests indicate both alternate films as well as showing dates.

AFNR 49—Air Force News Review No. 49. Highlights of 1959.

FTA 458—Techniques of Exhaled-Air Artificial Respiration.

SFP 263—The Air Force Story—Vol. II, Chapter 3—On to the Yalu.

SFP 263—The Air Force Story—Vol. II, Chapter 2—Meeting the Red Challenge.

SFP 623—Shield Against Invasion.

SFP 621— ASTIA—Armed Services Technical Information Agency.

SFP 663—Two Hats. Lawyer, clerk, fireman one day—airmen fighting in defense of their country the next.

TF 1-5291—Ballistic Missile Trajectories.

TF 1-5294—Space Guidance and Control.

TF 1-5295—Space Navigation.

TF 1-5302a—The Mission Support During Radioactive Fallout—Disaster Control.

TF 1-5302b—The Mission Support During Radioactive Fallout—Fallout Shelters.

TF 1-5302c—The Mission Support During Radioactive Fallout—Exposure Control.—END

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Polybius the historian tells of a data link system employed at the time Alexander the Great and his Macedonian cavalry crushed the Greek forces of Demosthenes and reduced Greece to a dependent status for the remainder of classical antiquity. It consisted of a series of signal walls on which torches were displayed in combinations representing letters of the Greek alphabet. Although slow, the system proved superior to the use of couriers.

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